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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 121. — 130

B. T. GALLOWAY, *Chief of Bureau.*

MISCELLANEOUS PAPERS.

I. THE SUPPOSED RELATIONSHIP OF WHITE SNAKEROOT TO MILKSICKNESS, OR "TREMBLES."
By ALBERT C. CRAWFORD, *Pharmacologist, Poisonous-Plant Investigations.*

II MOUNTAIN LAUREL, A POISONOUS PLANT.
By ALBERT C. CRAWFORD, *Pharmacologist, Poisonous-Plant Investigations.*

III. RESULTS OF LOCO-WEED INVESTIGATIONS IN THE FIELD.
By C. DWIGHT MARSH, *Expert, Poisonous-Plant Investigations.*

LABORATORY WORK ON LOCO-WEED INVESTIGATIONS.
By ALBERT C. CRAWFORD, *Pharmacologist, Poisonous-Plant Investigations.*

IV. THE SOURCES OF ARSENIC IN CERTAIN SAMPLES OF DRIED HOPS.
By W. W. STOCKBERGER, *Expert, Drug-Plant Investigations.*

V. APPLE LEAF-SPOT CAUSED BY SPHAEROPSIS MALORUM.
By W. M. SCOTT, *Pathologist*, and JAMES B. RORER, *Assistant Pathologist, Investigations of Diseases of Fruits.*

VI. THE IMMUNITY OF THE JAPANESE CHESTNUT TO THE BARK DISEASE.
By HAVEN METCALF, *Pathologist in Charge of the Laboratory of Forest Pathology.*

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BUREAU OF PLANT INDUSTRY.

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[a] The seven papers constituting this bulletin were issued in separate form on January 28, February 20, January 28, January 28, February 21, March 12, and February 10, 1908, respectively.

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MISCELLANEOUS PAPERS.

B. P. I.—321.

THE SUPPOSED RELATIONSHIP OF WHITE SNAKEROOT TO MILKSICKNESS, OR "TREMBLES."[a]

By Albert C. Crawford, *Pharmacologist, Poisonous-Plant Investigations.*

HISTORICAL INTRODUCTION.

Many of the early settlers of the Ohio Valley, especially in Indiana and Illinois, were affected with a peculiar disorder known as milksickness, a disease which is said to have caused the death of Abraham Lincoln's mother. Persons with this disorder usually showed no mental disturbances save slight apathy, although late in the course of the disease there might be coma.

Milksickness was usually characterized by vomiting, which might be bloody, and obstinate constipation, but in rare cases this was absent.[b] So marked was this constipation that the name paralysis of the intestines was once suggested for the disorder.[c] The abdominal walls were retracted and the pulsations of the abdominal aorta could thus be easily seen. Later in the course of the disease tympanites has occurred.[d] The urinary secretion was diminished and the breath took on a peculiar fetid odor which was considered pathognomonic.

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[a] One of the most serious diseases which formerly threatened the life of man and beast in the forested parts of the Ohio Valley and adjacent territory was that known as milksickness, or "trembles." Although of late years much less trouble has been experienced, an occasional outbreak is reported.

In responding to a request that the United States Department of Agriculture investigate an attack of milksickness occurring near Peoria, Ill., a favorable opportunity was obtained to test the widespread and persistent popular belief that the plant known as white snakeroot (*Eupatorium ageratoides* L. f.) is responsible for the trouble.

After a study extending through several months, Dr. Albert C. Crawford, Pharmacologist, acting under the direction of Dr. R. H. True, Physiologist in Charge of the Poisonous-Plant Investigations of this Bureau, has shown in the results summarized in this technical paper that the eating of the plant of the white snakeroot by animals or man is not followed by the disease and that there is probably no relation between them.—B. T. Galloway, *Chief of Bureau.*

[b] Crookshank, N. On the "Sick Stomach" of the Western Country, or Gastro-enteritis. Phila. Jour. Med. and Phys. Sci., vol. 12, p. 254, 1826.

[c] Dawson, J. Causes and Treatment of Milksickness. Proc. Med. Convention, Ohio, 1842, p. 48.

[d] Wood, G. B. Treatise on the Practice of Medicine, vol. 1, p. 462, 1858.

Associated with these symptoms were those of prostration, with restlessness and great thirst. Pain was referred to various localities. The temperature usually remained normal or was subnormal, rarely exceeding 99° F.[a] At times it reached 100° F. There are, however, very few recorded cases in which the temperature was actually measured by a thermometer.[b] The pulse remained about normal, but might at times be accelerated. Nothing very characteristic was noted concerning the tongue save that it was enlarged.[c] In certain cases difficulty in swallowing was reported; in others hiccough was a more or less prominent symptom.[d] No reports were made as to the condition of the pupil or of any ocular disturbances save an intolerance of light.[e]

There was said to be an incubation period of from two to ten days,[f] although apparently some cases had no such period.[g] The disease itself usually lasted from two to twenty days, but chronic cases are reported.[h] The disorder generally occurred in spring or autumn, particularly in autumn, although it might appear at any season.[i] The conditions which were especially favorable for its development were said to be those which interfered with normal excretion.[j] One attack gave no immunity, but rather predisposed to a second one.[k]

The post-mortem records are few in number. The only lesions reported are those of irritation and inflammation of the stomach and intestines,[a] as shown by hemorrhages into the lumen of these organs and injection of their walls, with at times adhesion of the intestinal walls to one another.[b] The pyloric region was found contracted,[c] and Peyer's and Brunner's glands were swollen. Graff has reported in one case adhesions and thickening of the cerebral membranes.[d] In other cases in which autopsies were made very slight lesions were noted.[e]

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[a] Kimmell, J. A. Milk Sickness in America. Verhandl. d. X internat. med. Cong., vol. 2, pt. 5, p. 54, 1891.

[b] Hurd, A. Milk Sickness. Clinic, Cincinnati, vol. 9, p. 280, 1875.—Way, J. H. Clinical History, Nature and Treatment of "Milk-Sickness." Amer. Jour. Med. Sci., n. s., vol. 106, p. 310, 1893.—Yandell, L. P. Inquiry into the Nature of the Disease Called Milk-Sickness. West. Jour. Med. and Surg., 3 s., vol. 9, p. 393, 1852.—Drake, D. Memoir on the Disease Called by the People "Trembles." West. Jour. Med. and Surg., vol. 3, p. 178, 1841.

[c] Graff, G. B. On the Milk Sickness of the West. Amer. Jour. Med. Sci., n. s., vol. 1, p. 354, 1841.

[d] Coleman, A. Observations on the Disease Generally Known by the Name of the Sick Stomach. Phila. Jour. Med. and Phys. Sci., vol. 4, p. 325, 1822.

[e] Graff, G. B., l. c., p. 354.

[f] Beach, W. M. Milk Sickness. Trans. Ohio State Med. Soc., vol. 38, pp. 131, 133, 1884.—Kimmel, J. A., l. c., p. 50.

[g] Yandell, L. P., l. c., p. 394.

[h] Yandell, L. P., l. c., p. 392.—Kimmell, J. A., l. c., p. 54.

[i] Byford, W. H. Milk Sickness. Nashville Jour. Med. and Surg., vol. 9, p. 467, 1855.—Yandell, L. P., l. c., p. 379.—Beck, J. C. Milk-Sickness. North-West. Med. and Surg. Jour., vol. 14, p. 497, 1857.

[j] Philips, W. H. Milk Sickness. Cincinnati Lancet and Observer, vol. 38, p. 142, 1877.

[k] Philips, W. H., l. c., p. 147.—Yandell, L. P., l. c., p. 392.

The clinical symptoms of some cases of milksickness resemble closely those described by Vaughan and Novy under the name galactotoxismus[f] and would probably be so diagnosed if they occurred outside of the areas where milksickness is prevalent. Schmidt[g] suggested that cases of milksickness occurred in cities, but were not diagnosed as such. Other cases resemble other forms of ptomaine poisoning described by Vaughan,[h] while the symptoms of still others resemble those occurring in Van Ermengem's cases of sausage poisoning. These cases described by Van Ermengem[i] showed marked nausea and vomiting and severe constipation, although two cases had diarrhea. There was retention of urine, while the temperature, pulse, and mental symptoms remained about normal, as in cases of milksickness. Some difficulty in swallowing was noted and there were ocular disturbances—diplopia, dilatation of the pupil, ptosis, etc. The post-mortem examination, as in milksickness, showed no characteristic macroscopic lesion. From the spleen was isolated an anærobic bacillus which could reproduce the symptoms of the disorder in animals. This organism was found in various places in the meat used in making the sausage. On culture media it developed an odor of butyric acid. The toxin obtained from these cultures would resist heating at 70° C. for a short time, but heating to 100° C. destroyed it at once. Van Ermengem mentions that in cats injected with this toxin there was muscular rigidity and that the ocular symptoms in these animals were not marked. Dogs, however, were very resistant to the action of this toxin. This organism has also been found in the fæces of hogs. A similar outbreak occurred in Darmstadt after eating vegetables infected with the same organism.[a]

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[a] De Bruler, J. P. Milk-Sickness. Chicago Med. Jour., vol. 15, p. 209, 1858.

[b] Davis, K. H. Milk-Sickness. Atlanta Med. Reg., vol. 1, p. 394, 1881–82.

[c] Byford, W. H., l. c., p. 465.—Drake, D. Morbid Anatomy of Milksickness. West. Jour. Med. and Surg., vol. 4, 1841, p. 234.

[d] Graff, G. B., l. c., p. 366.

[e] Crookshank, N., l. c., p. 256.

[f] Vaughan, V. C., and Novy, F. G. Cellular Toxins, 1902, p. 216. Compare Graff, G. B., l. c., p. 364; also Walker, J. W., Milk-Sickness, Science, vol. 8, p. 483, 1886.

[g] Schmidt, C. H. Milk Sickness. Cincinnati Lancet and Observer, vol. 20, p. 412, 1877.

[h] Vaughan, V. C. Ptomaïnes, Toxins and Leucomaïns. Twentieth Century Practice, vol. 13.

[i] Van Ermengem, E. Ueber einem neuen anaerob. Bacillus u. seine Beziehungen z. Botulismus. Zeits. f. Hygiene, vol. 26, p. 1, 1897; Untersuch. ü. Fälle v. Fleischvergift. mit Symptomen v. Botulismus. Cent. f. Bakter., part 1, vol. 19, p. 442, 1896.—Römer, P. Ein Beitrag z. Aetiologie des Botulismus. Cent. f. Bakter., part 1, vol. 27, p. 857, 1900.—Kempner, W., and Pollack, B. Wirkung des Botulismustoxins (Fleischgiftes) und seines specifischen Antitoxins auf die Nervenzellen. Deutsch. Med. Woch., vol. 23, p. 505, 1897.—Brieger and Kempner, W. Beitr. z. Lehre von der Fleischvergift. Deutsch. Med. Woch., 1897, p. 521.—Kempner, W. Weiterer Beitrag z. Lehre von den Fleischvergift. Das Antitoxin des Botulismus. Zeits. f. Hygiene, vol. 26, p. 481, 1897.—Osler, W. Modern Medicine, vol. 1, p. 232, 1907.

No doubt the term "milksickness" has been made to embrace a variety of clinical conditions; in fact, there has been such confusion in the reports that some authors, as Yandell, have denied its existence as a peculiar entity.[b]

The mortality as given by Coleman [c] is one death in every twenty or thirty cases. Others, as Mendenhall,[d] allude to milksickness as a "very grave disease"; others, again, speak of the outlook as favorable under the proper treatment.

In the same portions of the country in which milksickness occurred a similar, if not identical, disorder also affected domestic animals, especially cattle. In them muscular tremors were present and became especially noticeable when the animals were driven, so that this disorder received the name of "trembles."[e] It was also called the "tires," on account of the disinclination of the animals to move. A rigidity of the muscles has been noted by McCall.[f] The post-mortem examination showed the gastric mucosa to be softened and the stomach and intestines contracted,[g] in some cases gangrenous,[h] and at times there was more or less peritonitis. The odor developing at some of these autopsies was especially offensive and was compared with the odor arising in mercurialism.[a] In one case the cerebral ventricles contained fibrin and the brain itself was surrounded by serum and pus.[b] The spinal cord in this case showed signs of inflammation. In other cases no special lesions were noted.[c]

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[a] Fischer, A. Ueber eine Massenerkrankung an Botulismus infolge Genusses "verdorbener" Bohnenkonserven. Zeits. f. klin. Med., vol. 59, p. 58, 1906.

NOTE.—The bacillus *Aeroganes capsulatus* which occurs in the human intestinal tract may give rise to infections associated with constipation. See Herter, C. A., Common Bacterial Infections of the Digestive Tract, 1907, p. 207.

[b] Yandell, L. P., l. c., p. 398.—Hibberd, J. F. Observations on Milk-Sickness. Western Lancet, 1845, vol. 3, p. 448.

[c] Coleman, A., l. c., p. 325.

[d] Mendenhall, I. Milk-Sickness. Chicago Med. Jour., vol. 18, p. 435, 1861.

[e] Yandell, L. P., l. c., p. 398.

[f] McCall, A. Facts and Observations on the Milk Sickness. West. Jour. Med. and Phys. Sci., vol. 3, p. 467, 1830.

[g] Graff, G. B., l. c., p. 362.

[h] Dickey, W. Essay on Milk Sickness. Western Lancet, vol. 13, pp. 391–395, 1852.

It was proved that many cases of milksickness were communicated to man by means of milk and its products[d] or meat[e] obtained from cattle affected with the "trembles"; even the amount of cream usually added to coffee is said to have induced the disease.[f] Other cases apparently arose without the products of diseased animals being eaten, as by using contaminated water;[g] and, again, cases have occurred in vegetarians.[h] In some cases the fencing off of the suspected springs from the pasture was followed by the disappearance of "trembles" from the neighborhood. The "trembles" still appear at times, although much less common than formerly,[i] its disappearance being traced to the cultivation of the soil;[j] and it is associated with certain shady, sharply localized, wet, untilled areas. No characteristic geological peculiarity has been proved for these areas.[k] Drake met the disorder almost entirely on oak plateaus, and especially on the so-called "slashes" or marshy areas.[l] It is claimed that the disease is contracted by leaving the cattle in these areas over night and that the disorder can be avoided by withdrawing them from pasture before dark.[a] Corn fodder experimentally exposed to the dew in these areas communicated the disorder to a yearling.[b]

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[a] Drake, D., l. c., p. 172.—McCall, A., l. c., p. 467.

[b] Graff, G. B., l. c., p. 363.

[c] Philips, W. H. Milksickness. Cincinnati Lancet and Observer, vol. 20, p. 132, 1887.—Beach, l. c., p. 137.

[d] Drake, D., l. c., p. 194.—Wilkinson, G. W. Etiology of Milksickness. Northwest. Med. and Surg. Jour., vol. 14, p. 156, 1857.—Townshend, N. S. Milk-Sickness. Jour. Comp. Med. and Surg., vol. 4, p. 118, 1883.—Schmidt, C. H. Milk Sickness. Cincinnati Lancet and Observer, vol. 20, p. 411, 1877.

[e] Yandell, L. P. Report on Milk Sickness. Proc. State Med. Soc. Kentucky, p. 94, 1868. [Gives negative reports.]

[f] Graff, G. B., l. c., p. 359.

[g] Crookshank, N. Observations on the Milk Sickness, Cincinnati, 1840, p. 11; Sick Stomack, Ohio Med. Rep., vol. 1, p. 11, 1826.—Yandell, L. P. Inquiry into the Nature of the Disease Called Milk-Sickness, West. Jour. Med. and Surg., 3 s., vol. 9, pp. 383, 389, 1852.—Walker, J. W. Milk-Sickness. Science, vol. 8, p. 483, 1886.—Wilkinson, G. W., l. c., p. 158.—Thompson, S. W. Milk-Sickness. West Jour. Med. and Surg., 3 s., vol. 11, p. 480, 1853.—Jones, J. T. Short Essay on Milk Sickness. East Tenn. Rec. Med. and Surg., vol. 1, p. 330, 1852–53.

[h] Jones, J. T., l. c., p. 329.

[i] Connor, J. J. Further Contribution to the Subject of Milk-Sickness. Chicago Clinic, vol. 17, p. 333, 1904.

[j] Yandell, L. P., l. c., p. 387.—Walker, J. W., l. c., 540; also Trans. Indiana State Med. Soc., 1873–75, p. 128.

NOTE.—Some areas are not entirely freed by cultivation.

[k] Yandell, L. P., l. c., p. 379.

NOTE.—J. S. Seaton in his "Treatise on the Cause of the Disease Called by the People the Milksickness," p. 10, claims that he can pick out milksick areas by the geological conditions.

[l] Drake, D., l. c., p. 184.

One of the peculiarities claimed for this disease is that cows will show no symptoms so long as they are milked, while their nursing calves die with typical symptoms, but when the milking ceases the cows develop the symptoms in the usual manner. In other words, the poisonous agent is partially eliminated by the milk.[c] The urine is also claimed to eliminate a portion of the poisonous body.[d] The suspected milk in some cases was noted to be of a greenish color,[e] but usually there was no characteristic noted which is peculiar to it.[f]

The disease was apparently known to the early French missionaries in the eighteenth century, but accounts of it first appeared in medical literature in 1809–10.[g] They were numerous from 1840 to 1850, but now notices seldom appear.

The etiology of this disorder has remained in doubt, and Osler,[h] in an address before the young medical officers of the United States Army, mentions its causation as one of the many intricate problems remaining to be solved. Rewards were at one time offered by several States for the solution of this question, but these do not hold at present. Opinion has been divided as to whether "trembles," or milksickness, is of parasitic origin or due to the eating of certain plants, as *Rhus toxicodendron* or *R. venenata*,[i] *Bignonia capreolata*,

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[a] Beach, W. M. Milk-Sickness. Trans. Ohio State Med. Soc., vol. 38, pp. 128, 130, 1884.—Lea, W. W. Cursory Remarks on a Disease Vulgarly Called Milk Sick. Phila. Jour. Med. and Phys. Sci., vol. 2, p. 51, 1821.—Way, J. H., l. c., p. 312.

[b] Walker, J. W., l. c., p. 483.

[c] Kimmell, J. A., l. c., pp. 50, 52.—Drake, D., l. c., pp. 198, 200.—Graff, G. B., l. c., p. 360.

[d] Graff, G. B., l. c., p. 360.

[e] McCall, A. Facts and Observations on the Milk Sickness. West. Jour. Med. and Phys. Sci., vol. 3, p. 467, 1830.

[f] Graff, G. B., l. c., p. 359.

[g] Drake, D., l. c., p. 162; also West. Jour. Med. and Phys. Sci., vol. 3, p. 482, 1830.

[h] Osler, W. Aequanimitas, 1904, p. 116.

[i] Landrum, Z. C. Rhus Toxicodendron, the Cause of Milk Sickness. Atlanta Med. and Surg. Jour., vol. 7, A, p. 1, 1861.—Chase, S. C. Cause of Milk-sickness. Chicago Med. Jour., vol. 18, p. 438, 1861.—McIlhenny, J. J. Treatise on the Disease Called the Milk-Sickness, Springfield, 1843, p. 6.—Nichols, J. H. Milk-Sickness. Clinic, Cincinnati, vol. 10, p. 26, 1876.—Brewington, W. J. Milk-Sickness. Clinic, Cincinnati, vol. 10, p. 76, 1876.—Crook, J. W. Twenty Propositions on Milk-Sickness. North-West. Med. and Surg. Jour., vol. 14, p. 491, 1857.—Jones, J. T. Short Essay on Milk Sickness (*Colica trementia*). East Tenn. Rec. Med. and Surg., vol. 1, p. 324, 1852–53.

Eupatorium ageratoides, *Lobelia inflata*, etc.[a] Graff[b] eliminated arsenic, copper, etc., as causative factors and showed that small quantities of the butter or cheese (1 ounce) or of the beef (4 ounces) obtained from animals with the "trembles," if fed to a dog three times a day, would reproduce the symptoms in forty-eight hours and cause death in from three to six days; but his inoculations failed to produce the disorder. Graff adds that the poisonous principle seems to possess the power of infinite reproduction, stating, "It will be found that each pound of flesh of that animal so destroyed will possess as active powers of destruction, and will, in its turn, serve to contaminate the whole body of another animal in the same degree." Vermilya[c] claims that he was able to reproduce the disorder by feeding *Eupatorium ageratoides* and that his experiments were corroborated by Rowe, but A. W. Bitting, of Lafayette, Ind., reported to this Department his experiments in which he fed a horse 210 pounds (105 kilos) of this fresh green plant in five days without serious effect. He also fed two lambs with 80 pounds (40 kilos) without effect. Similar experiments are reported by Drake.[d] The theory of a plant poison was emphasized, as herbivorous animals were supposed to be the first affected and from them the disease transmitted to the carnivora, although the cases do not always originate in herbivora.[e]

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[a] Jerry, W. The Plant that Causes Milk Sickness. Med. and Surg. Rep., vol. 16, p. 270, 1867.—Drake, D., l. c., pp. 213–224.—Jones, J. T., l. c., p. 324.

[b] Graff, G. B., l. c., pp. 357, 360, 362.

Note.—Graff says the meat is active "raw or boiled," but there is evidently some mistake, as he states on page 361 that "I boiled a large quantity of the beef in pure water for several hours, and afterwards evaporated the liquid thus obtained to the consistence of cream. Although this extract contained a large quantity of gelatinous matter, with some of the other constituents of the flesh, yet, on being given in large quantities, no perceptible effect was produced."

Compton, J. W. Milk-Sickness. Indiana Med. Reporter, vol. 2, p. 255, 1881.

[c] Ohio State Board of Agriculture, 13th Ann. Rept. for 1858, 1859, p. 673.—Barbee, J. W. Facts Relative to the Endemic Disease Called by the People of the West Milk-Sickness. Western Jour. Med. and Surg., vol. 1, p. 182, 1840.—Drake, D., l. c., p. 214.

Note.—The view that arsenic is the etiological factor in milk-sickness has been strenuously upheld by Seaton in his Treatise on the Cause of the Disease Called by the People the Milksickness. Louisville, 1841.

[d] Drake, D., l. c., pp. 215–217.

Note.—The cases described by Barbee in the Western Journal of Medicine and Surgery, vol. 1, p. 182, 1840, in which dogs were killed with decoctions of this plant, seem to be merely cases of so-called salt action.

[e] Compare Jones, J. T., l. c., p. 328.

In 1843 Heeringen,[a] and later, in 1853, Heusinger,[b] compared this disorder to anthrax, and in 1858 Wood on purely literary evidence argued the presence of "a germ."[c] Byford,[d] and De Bruler[e] called attention to the fact "that it undergoes multiplication in the system" and that it lost none of its virulence by passing through four successive animals. Gardner[f] and Hessler[g] claim to have found parasites in the blood, while Philips[h] compares the organism seen by him to that met with in relapsing fever. The examinations of the blood made by Schmidt were negative.[i] Molds and mushrooms also have been claimed to be the etiological factors.[j] No one has yet reproduced the disease by injection of pure cultures of organisms.

The question thus remained in doubt, with the weight of evidence in favor of a parasitic origin, when a paper by Moseley[k] appeared. As his paper attributes the origin of this disorder to the eating of *Eupatorium ageratoides*, or white snakeroot, it was deemed advisable to analyze his evidence, as follows:

Experiment No. 1.—This consisted in feeding a cat weighing 4½ pounds (2,041 grams) with a solution made by extracting the leaves of three or four (?) plants in one pint (473 c. c.) of milk. After taking about one-half gill (59 c. c.) of this extract the animal showed tremors and dullness and was found dead in about twenty-six hours. The post-mortem examination proved to be negative. It is possible in this case that bacteria may have developed in the milk and produced poisonous compounds before feeding. This experiment was performed by Moseley's assistant and the animal was not seen by him until after death.

Experiment No. 2.—A tramp kitten of unknown history weighing 30 ounces (850.5 grams) was fed with a decoction made from one-half pound (226.8 grams) of the fresh plant and also some milk extract of the plant, more of the plant than the first (a larger cat) received. The cat was dull and showed tremors at times after the first feeding, but the appetite remained good, and eleven days later trembling could still be seen. Eighteen days later the animal was fed on the carcass of a rabbit which had died after eating the same plant (see experiment No. 6). This rabbit had died three days before the feeding of the cat began. Some tremors were seen in the cat, but it ate and continued active for three days, when it was killed. This experiment is open to the objection that nothing was known of the cat previous to the feeding, and cats often show slight tremulous movements of the cutaneous muscles. Then again, granting that the tremors were due to eating the meat, no record is made of having preserved the rabbit meat on ice, and decomposition may already have begun, and the mere presence of muscular tremors of unknown origin without the other clinical symptoms does not indicate the disease known as "trembles."

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[a] Heeringen, E. Discovery of the True Cause of the Disease Called by the People Trembles, or Milksickness. Louisville, 1843.

[b] Heusinger, C. F. Recherches de Path. Comp., vol. 1, p. 126, 1853.

[c] Wood, G. B., l. c., p. 465.

[d] Byford, W. H., l. c., p. 467.

[e] De Bruler, J. P., l. c., p. 209.

[f] Gardner, J. Milk-Sickness. St. Louis Med. and Surg. Jour., vol. 38, p. 290, 1880.

[g] Hessler, R. Preliminary Notes on an Almost Extinct Native Disease, Trembles or Milk-Sickness. Proc. Indiana Acad. Sci. for 1905, p. 122.

[h] Philips, W. H., l. c., p. 139.

[i] Schmidt, C. H., l. c., p. 112.

[j] Wilkinson, G. W., l. c., p. 159.—Howard, E. J. Mukosma. Indiana Jour. Med., vol. 2, p. 370, 1871.—Borland, S. Essay on the Milk Sickness, p. 27, Little Rock, 1845.—Drake, D., l. c., p. 218.—Johnson, J. M. Milk-Sickness. Atlanta Med. and Surg. Jour., vol. 7, B, p. 293, 1866. Compare also Mitchell, J. K., Five Essays.

[k] Moseley, E. L. The Cause of Trembles in Cattle, Sheep, and Horses and of Milksickness in People. Ohio Naturalist, vol. 6, pp. 463 and 477, 1906.

Experiment No. 3.—A cat whose previous history was not given was fed on the same carcass given to the cat referred to in experiment No. 2, and on that referred to in experiment No. 7, after it had stood two days, and the feeding was continued three days; then it was fed on a similar rabbit two days after death. This animal showed tremors and died in twenty days. The temperature of this animal rose about 2½° F. on the third day before death. The buttocks were reported soiled, so evidently it had no marked constipation. Now, constipation is a symptom which Kimmell, Drake, Chesney, Graff, and others had previously noted in animals affected with the "trembles," and is one of the characteristics of milksickness.[a] Post-mortem examination showed two ounces of *acid* fluid in the peritoneal cavity.

Experiment No. 4.—A cat which was sick before beginning the experiment was fed with a milk extract of the plant, but only showed light symptoms (diarrhea) and "was seen to tremble only a few times and then under conditions which might probably have produced trembling without the aid of any poison." This animal was then fed on meat from one of the rabbits used in previous experiments. Moseley said that "the meat seemed to affect him more than the milk."

Experiment No. 5.—A dog was fed on an aqueous extract of the plant mixed with milk and some chopped-up plant mixed in hash and showed some trembling and weakness, but Moseley adds "he was not so different from usual except in the early morning but what all these things might have escaped notice if he had not been watched." In other words, an animal which Graff had shown to be very susceptible to the "trembles," when fed with *Eupatorium ageratoides*, the supposed carrier of the disease, showed practically no symptoms. He then adds the remarkable report of his assistant: "While I held the dog's mouth open a friend poured the extract into the dog's mouth. The dog choked and coughed the extract into my face and mouth. I was in a room while the mixture was steeping and also on the previous evening. At 10.30 I was taken with a fit of cramps and the following day was nauseous. Several times during the three following days I had fits of trembling, always accompanying the extension of limb." In this connection it may be stated that the present writer's laboratory assistant and himself squeezed their material by hand, handled it, and made their own extracts in a rather close room without experiencing any such effects.

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[a] Chesney, J. P. Milk Sickness. St. Joseph Med. and Surg. Rep., vol. 1, p. 99, 1880.—Kimmell, J. A., l. c., p. 51.—Drake, D., l. c.; cow, p. 170; horse, p. 173; dog, p. 174.—Graff, G. B., l. c., p. 360.

Experiment No. 6.—In this case 2 ounces (56.7 grams) of the snakeroot was placed in the cage with a rabbit. The rabbit died in three days. No tremors had been noted. This case can be excluded because of the absence of any accurate clinical report or histological examination, as rabbits are very apt to die of intercurrent diseases, especially coccidiosis.

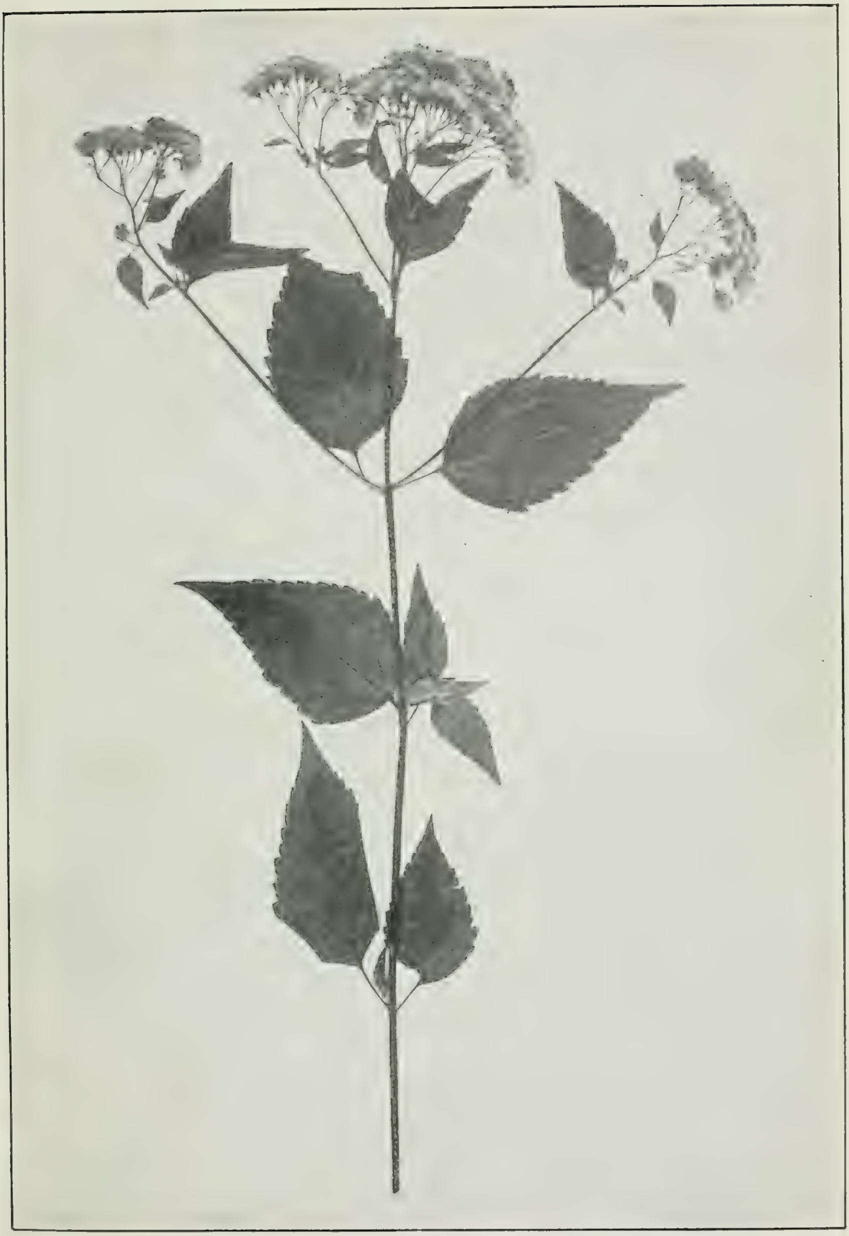
Experiment No. 7.—This is of the same type as experiment No. 6, and open to the same objection. Moseley merely quotes the report of his pupil as to the presence of tremors.

Experiment No. 8.—This experiment consisted in injecting subcutaneously into a rabbit weighing 1,383 grams an aqueous extract of 3 grams of the plant. This injection was followed by tremors. Three days later the animal was fed with 2 to 3 ounces (57.7 to 85 grams) of the leaves and branches, and died in one hundred and twenty hours. There was no constipation. Moseley says, "The effects on her actions and appearance were not striking and might have escaped notice if I had not looked for them."

Experiment No. 9.—A rabbit was fed for three days with an aqueous extract of the plant. The only result noted was a "tremulous motion of the sides, with more rapid respiration." This animal was then fed with a milk extract of the plant. No constipation resulted, but the same trembling was seen, and save for a slight lessening of strength "she has seemed well."

Experiment No. 10.—This experiment consisted in feeding a milk extract of the plant, but with only slight action. A rabbit was reported to tremble after eating 67 grams of the leaves and branches of a fresh plant, but survived.

Experiment No. 11.—A young lamb weighing 40 pounds (18.14 kilos) was fed with the leaves of this plant. The animal showed trembling and died in four days, having eaten about 29 ounces (822 grams). There was no constipation. The kidneys were found to be



FLOWERING BRANCH OF WHITE SNAKEROOT (EUPATORIUM AGERATOIDES, L. F.).

much enlarged, weighing about twice as much as normal. One can form no positive opinion as to the cause of death. The enlarged kidneys, taken in connection with the history of convulsions and fluid in the peritoneal cavity, might suggest a nephritis.

Six ounces (170 grams) of the liver of this animal were fed to a cat. This cat showed merely a few tremors. A second cat also ate 6 ounces (170 grams) of the muscles but showed no tremors, and a dog after eating 4 ounces (103.4 grams) of the liver showed no symptoms save some dullness, but after feeding on the heart and spleen some tremors were noticed. None of these animals died.

These experiments, taken in the light of Graff's work, indicate that the sheep had not the disease commonly known as "trembles."

Moseley explains the lack of results in some of his experiments by the existence of a hypothetical immunity, but cases of milksickness are known not to possess immunity—in fact, one attack rather predisposes to another, so that it can not be said that Moseley has even proved *Eupatorium ageratoides* to be a poisonous plant, much less the cause of "trembles."

RECENT INVESTIGATIONS.

In the month of August, 1906, a rather serious outbreak of milksickness, or as it is frequently called in the case of stock "trembles," occurred in the vicinity of Minooka, Ill., resulting in the death of about 50 head of cattle. The office of Poisonous-Plant Investigations was asked to undertake an investigation into the cause of the trouble. In view of the fact that only plants as popularly understood are the subject of investigation by this office, only plants were studied. The widespread and popular belief that the eating of the white snakeroot (*Eupatorium ageratoides*), illustrated in Plate I, is the cause of the trouble seemed to direct the principal efforts of the investigations toward that common plant. It was found in considerable quantities in pastures in which the animals were supposed to have contracted the disease, and in a number of patches the plants had been browsed, presumably by the stock. Material from these patches, both dried and in chloroform water, was preserved for study.

EFFECT OF WHITE SNAKEROOT ON RABBITS.

EXTRACTS FROM DRY PLANT.

To prepare the material for use, 200 grams of the dry herb were extracted with cold water and the extract evaporated to the desired concentration in vacuo at about 55° C. When such an extract was fed to a rabbit weighing 4 pounds 2 ounces (1,871 grams) no symptoms were noted, either immediately or on the following day. Two days after the first dose a like quantity was again administered and no symptoms appeared, the rabbit weighing 4 pounds 5 ounces (1,956 grams). After receiving three further doses, representing 200 grams each, in a period of five days the animal showed no symptoms of "trembles" or of suffering of any sort, the weight increasing under this treatment to 4 pounds 8 ounces (2,041 grams). The animal which had received this treatment gave normal delivery to young and made a rapid recovery, the young appearing abnormal in no respect. Thus, although the rabbit received the equivalent of 1,000 grams of the plant in a week, no symptoms of milksickness appeared and the animal steadily gained in weight.

After a rabbit weighing 4 pounds (1,814.3 grams) was injected subcutaneously in the back with an extract of 20 grams of the dried plant muscular tremors were felt in the limbs and in the masseter muscles, but recovery followed.

When a quantity of the same extract representing 40 grams was injected into a rabbit weighing 4 pounds 1 ounce (1,842.7 grams) no results followed, but an extract of 60 grams of the dried plant proved fatal in about twelve hours, the animal showing distinct tremors.

Following the injection of an aqueous extract representing 5 grams of the dried plant into a rabbit weighing 3 pounds 8 ounces (1,587.5 grams) there were no tremors and the rabbit was apparently normal, though the temperature rose 2.2 degrees F. in two hours and twenty-five minutes after the injection.

A rabbit weighing 3 pounds 12 ounces (1,700.8 grams) was injected subcutaneously with a concentrated extract representing 10 grams of dried Eupatorium and no tremors resulted, but in the two and one-half hours following the injection a fall of one-half a degree in the temperature was noted. Death followed during the night.

On increasing the quantity of extract until it represented 20 grams of the dried plant and injecting this subcutaneously, slight tremors were felt on careful examination by the hand over the hips after almost an hour and a half. An hour and forty minutes later no tremors were felt and the rabbit seemed normal. The temperature two and one-fourth hours after injection fell 2 degrees F. Death ensued during the night.

These animals had been kept under observation for two weeks preceding the experiment and had shown nothing abnormal.

EXTRACTS FROM FRESH PLANTS PRESERVED IN CHLOROFORM.

To prepare extracts from material preserved in chloroform the fresh plant was placed in a container and covered with water containing enough chloroform to prevent fermentation. When wanted for use the liquid was pressed out of the plant and concentrated in vacuo to the proper degree. An extract representing 109 grams of the dried plant weighed after extraction (perhaps about 400 grams of the fresh plant) was given by mouth to a rabbit weighing 3 pounds 5 ounces (1,502.5 grams), but no symptoms were observed.

After a similar extract representing 127 grams of dry residue had been injected subcutaneously into the back of the same rabbit distinct tremors were shown in the hips and masseter muscles. Death followed during the night. No enlargement of the kidneys was seen.

EXTRACTS FROM ASH.

The method of preparation of extracts from ash was as follows: Ten grams of the dry herb were ashed in a platinum bowl and the ash washed into a porcelain bowl and carefully treated with acetic acid to decompose the carbonates, then evaporated to dryness and treated with water. The free acid was removed by repeated evaporation. The residue was treated with water, but not all dissolved, perhaps owing to the formation of basic salts. An emulsion consisting of the solution with the undissolved portion when injected subcutaneously produced marked tremors in the hips in rabbits after an hour and a quarter, and later in the masseter muscles. A marked acceleration of the respiration was also observed. After one and three-fourths hours the masseter muscles still twitched, but after two and one-fourth hours slight, if any, tremors were seen. No tremors were noted on the following day.

In ashing plants a large portion of the calcium-barium group will unite with the oxidized sulphur, forming insoluble sulphates, and thus be rendered inactive physiologically. Thus, trembling resulted from the injection of less of the inorganic salts than corresponds to 10 grams of the dry plant. This muscular twitching is well known to result from the hypodermic injection of certain salts (sodium, etc.), but not after administration by mouth.

An injection of a similar extract from 20 grams of the plant also produced the same result.

EFFECT OF WHITE SNAKEROOT ON CATS.

After an extract prepared from chloroform-preserved material corresponding to 50 grams of the dry plant residue was fed to a cat weighing 1 pound 8 ounces (680.3 grams), emesis followed in about fifteen minutes. When an aqueous extract corresponding to a dry plant residue of 39 grams was evaporated to 32 c. c. and 7 c. c. of this extract were fed twenty minutes after the emesis referred to and 11 c. c. were given thirty-five minutes later, urination and defecation followed promptly with renewed emesis in about ten minutes. Thirty minutes after the administration of the last dose of extract 14 c. c. more were fed, emesis again resulting in about eight minutes, followed about fifteen minutes later by further efforts toward elimination by the intestines. Since in both dogs and cats emesis is especially easy, no especial significance is to be attached to that phase of the results. No tremors resulted and the appetite remained as usual.

In order to reduce the liability to emesis which may follow the administration of large doses, smaller quantities of the extract were given. If 7 c. c. of an extract concentrated to 32 c. c., representing a dried plant residue of 39 grams, were fed, no emesis followed for three hours. On taking a further dose of 8 c. c. the animal vomited within ten minutes. However, five minutes after this, slight movements of the skin could be seen, but these were apparently only such cutaneous movements as are commonly observed in cats. After 6 c. c. more were fed emesis soon followed. The same result followed the feeding of 11 c. c. after a period of about fifty minutes.

During the course of feeding with Eupatorium extracts as above indicated, the cat gained an ounce in weight in a week, showing normal appetite and evacuations. After four days more the weight increased about 5½ ounces (155.8 grams).

After a further interval of two weeks without treatment, when a concentrated extract representing 35 grams of plant was fed, no tremors or other abnormal symptoms were to be noted, although the animal was kept under careful observation. When, on the day following, an extract representing 65 grams was given no symptoms whatever followed other than evidence of a somewhat laxative action, and the cat continued to increase in weight. This animal gained 219 grams during the month it was kept under observation.

EFFECT OF WHITE SNAKEROOT ON DOGS.

An extract of Eupatorium representing 23 grams of the dried plant preserved in chloroform when fed to a dog kept under careful observation produced no symptoms, and the appetite remained normal; temperature before feeding, 100.6° F. When, twelve days later, a concentrated aqueous extract representing 200 grams of dried plant was given to the same dog, weighing 14 pounds 12 ounces (6,690.4 grams), having a temperature before feeding of 101° F., no symptoms resulted, the temperature after one and one-half hours registering 102° F. No symptoms appeared during observation for three more days, the weight increasing to 15 pounds 5½ ounces (6,959.8 grams). Eleven days later the weight increased to 16 pounds 15 ounces (7,682.7 grams). The animal was very playful throughout the investigation.

EFFECT OF WHITE SNAKEROOT ON SHEEP.

A lamb weighing about 25 kilos when fed 58 grams of the fresh plant showed merely some diarrheal symptoms.

EFFECT OF WHITE SNAKEROOT ON MAN.

The writer became so convinced of the harmlessness of the plant that he decided to take the plant extract himself. Four hundred grams of the fresh *Eupatorium ageratoides* were collected at Landover, Md., under the supervision of Prof. C. F. Wheeler, one of the botanists of the Department of Agriculture, and extracted carefully with water, chloroform being used as a preservative. This extract was evaporated in vacuo and made up to 154 c. c. At 11.10 a. m., September 30, 1907, 14 c. c. of this extract were taken. Seventy-four c. c. in all were taken by 1.45 p. m., without any special symptoms. The taste of the extract was exceedingly disagreeable. By 4.15 p. m. all but 40 c. c. had been taken; that is, an extract of over 300 grams. No untoward symptoms characteristic of milksickness were noted the following day; in fact, the writer never felt better.

To simulate the conditions which occur in herbivora, 100 grams of the dried plant from Illinois were digested with pepsin and pancreatin and the concentrated products taken by the writer in the period of one hour without the production of any serious symptoms.

SUMMARY.

To sum up, it certainly can not be said that it has been proved that milksickness is due to any constituent of *Eupatorium ageratoides*. The transmission of the disease by eating small quantities of meat or milk of animals sick with the "trembles" and the fact that cooked meat or boiled milk[a] does not produce this disorder point primarily rather to a parasitic origin, while the fact that *Eupatorium ageratoides*[b] is abundant in areas where the disease is not known and absent in some milksick areas[c] also indicates that the plant has no relation to the disease. If it does, it would be only an accidental carrier of some pathogenic organism.[d] According to reports, the same flora may be in the areas in which "trembles" occur as in those free from it, and milksickness is also said to occur where no vegetation grows (inclosed pens).[e] The disease also has disappeared from an area after simply clearing the woodland where it occurred and turning it into pasture.[a] Again, severe epidemics have occurred in winter when the foliage has disappeared, which would tend to exclude the higher, non-evergreen plants as the cause of this disorder. In fact, all the evidence in hand is against the causation of this disease by such plants, and certain analogies with cases of botulismus suggest a somewhat similar cause. If there is any truth in the statement that cattle exposed in pasture to night air especially contract the disease, this fact might suggest the more or less direct connection of some night organism as a carrier of the parasite, and certain parasites are supposed to be associated with certain localities.

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[a] Smith, C. H. Milk Sickness. Boston Med. and Surg. Jour., vol. 77, p. 471, 1867–68.—Wood, G. B. Practice of Medicine, vol. 1, p. 465, 1858.

NOTE.—Some toxins from infected meat are not injured by boiling.

[b] Wilkinson, G. W., l. c., p. 153.—Graff, G. B., l. c., p. 361.

[c] Brewington, W. J. Milksickness. The Clinic, Cincinnati, vol. 10, p. 77, 1876.

[d] Walker, J. W., l. c., p. 483.

[e] Wilkinson, G. W., l. c., p. 153.

Very little is known chemically of *Eupatorium ageratoides*.

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[a] Heeringen, E., l. c., p. 9.

NOTES.—A full bibliography can be found in Schuchardt, B., Die Milchkrankh. d. Nord Amerikaner, Janus, vol. 2, pp. 437, 525, 1897–98.

The most interesting experimental paper is that of Graff, while that of Drake is valuable for its fund of personal experiences as told by the settlers, and that of Schuchardt is the best literary handling of the question.

Eupatorium perfoliatum, a closely allied plant, has received some chemical attention, and a nonnitrogenous body, eupatorin, has been obtained. While the author states it will kill mice on subcutaneous injection, he fails to give the dose, and nothing can be drawn from this report as to its physiological activity.

Shamel, C. H. Eupatorin: The Active Principle of Eupatorium Perfoliatum. Am. Chem. Jour., vol. 14, p. 224, 1892.

Latin, G. Eupatorium Perfoliatum. Pharm. Jour. and Trans., 3 s., vol. 11, p. 192, 1881.

MOUNTAIN LAUREL, A POISONOUS PLANT.[a]

By Albert C. Crawford, *Pharmacologist, Poisonous-Plant Investigations.*

HISTORICAL INTRODUCTION.

Many members of the Ericaceæ, or heath family, contain principles which are injurious to man and to animals. Of these the members of the genus Kalmia especially interest us on account of their wide distribution in the United States and from the fact that many cases of poisoning in animals have been attributed to them. This genus is American in origin, but is found mainly in the Eastern States. The members of this group received their generic name in honor of Peter Kalm, but their popular name, laurel, was given on account of the resemblance of their leaves to those of the English laurel tree, a member of an entirely different family.[b] On account of the beauty and perfection of their flowers they were once proposed as a national emblem.[c]

Of these, mountain laurel (*Kalmia latifolia*), shown in Plate II, is probably the most important. North of Maryland it is usually known as mountain laurel, while south of Maryland it is sometimes known as ivy.[d] It has also received many other names, as calico bush,[e] laurel,[f] sheep laurel, mountain ivy,[g] wintergreen, great laurel,[h]

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[a] The mountain laurel, *Kalmia latifolia* L., has long been recognized by many people as one of our most deadly shrubs. It is a poison fatal to live stock, especially to sheep and goats, which seem more likely than cattle and horses to browse on it. The Bureau of Plant Industry is in receipt of letters inquiring into the facts concerning its action and the methods of treating poisoned stock.

Dr. Albert C. Crawford, Pharmacologist, under the direction of Dr. Rodney H. True, Physiologist in Charge of the Poisonous-Plant Investigations of this Bureau, has given the matter laboratory study with the results here briefly stated.—B. T. Galloway, *Chief of Bureau.*

[b] Kalm, P. Travels into North America, 2d ed., vol. 1, p. 263, London, 1772.

[c] Bailey, L. H. Cyclopedia of American Horticulture, 4th ed., vol. 3, p. 854, 1906.

[d] Gronovius, J. F. Flora Virgin., pt. 2, p. 160, 1743.

[e] Coulter, S. Catalogue of Flowering Plants * * * Indigenous to Indiana. Dept. Geol. and Nat. Resources of Indiana, 24th Ann. Rept., 1899, p. 607.

[f] Gronovius, J. F., l. c., p. 160.

[g] Smith, J. E. Natural History of the Rarer Lepidopterous Insects of Georgia, vol. 1, pl. 73, 1797.

[h] Cutler, M. Account of Some of the Vegetable Productions Naturally Growing in This Part of America. Amer. Acad. Arts and Sci. Mem., vol. 1, p. 442, 1785.

American laurel,[a] wicky, rose laurel, etc. The Pennsylvania mountain laurel[b] (*Rhododendron maximum*) is a closely allied species, while in California the name mountain laurel is applied to *Oreodaphne californica*,[c] a member of the family of Lauraceæ.

Mountain laurel usually occurs as a shrub, growing from 5 to 15 feet high, but in the Blue Ridge Mountains of North Carolina it has been seen reaching to a height of 25 or 30 feet.[d]

The species extends from New Brunswick and Canada to Florida, and through the Gulf States to Louisiana and Arkansas, but is especially abundant through the Eastern States along the Allegheny Mountains, where it forms dense, impenetrable thickets.[e] In spite of the name "mountain laurel" it grows on hills and banks in the lowlands, but especially along the courses of streams. The leaves are of a tough, leathery consistency and are evergreen. The flowers, which are nearly destitute of odor, have a peculiar arrangement of their stamens, which bend over with their brown anthers projecting into pockets in the corolla,[f] so that when this flower is visited by a bee they fly back, scattering the pollen over its own stigma, and also over the insect, which then carries it to other flowers, securing cross pollination. The flowers have a waxlike appearance and vary from a white to a rose color. The wood of the mountain laurel is close grained and hard and is a substitute for boxwood, and it may be used for making handles of small tools, etc.[g] The powder covering the leaves has been used as a snuff.[h] The laurel leaves have been utilized ever since the time of the colonists as one of the evergreens for Christmas decorations.[i]

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[a] Coulter, S., l. c., p. 607.

[b] Marshall, H. Arbust. Amer., p. 127, 1785.

[c] Reports of Explorations and Surveys * * for a Railroad from the Mississippi River to the Pacific Ocean, 1853–54. Senate Doc., 2d Sess., 33d Cong., vol. 13, pt. 4, p. 133, 1856.

[d] Aaron, C. E. Our Common Poisonous Plants. Cram's Magazine, 1900, vol. 2, p. 502.

[e] Sargent, C. S. Report on the Forests of North America, 10th Census, p. 98, 1884.

[f] The details as to the historical structure of this plant will be found in the following works:

Paschkis, H. Contributions to a Closer Knowledge of Some Little-Known Leaves. Pharm. Jour. and Trans., 3d ser., vol. 12, p. 86, 1881–82. Also Zeits. d. allg. oest. Apoth.-vereines, vol. 18, p. 434, 1880.

Breitfeld, A. Der anatom. Bau d. Blätter der Rhododendroideæ in Beziehung zu ihrer systematischen Gruppirung und zur geographischen Verbreitung. Botan. Jahrb., vol. 9, p. 319, 1887–88.

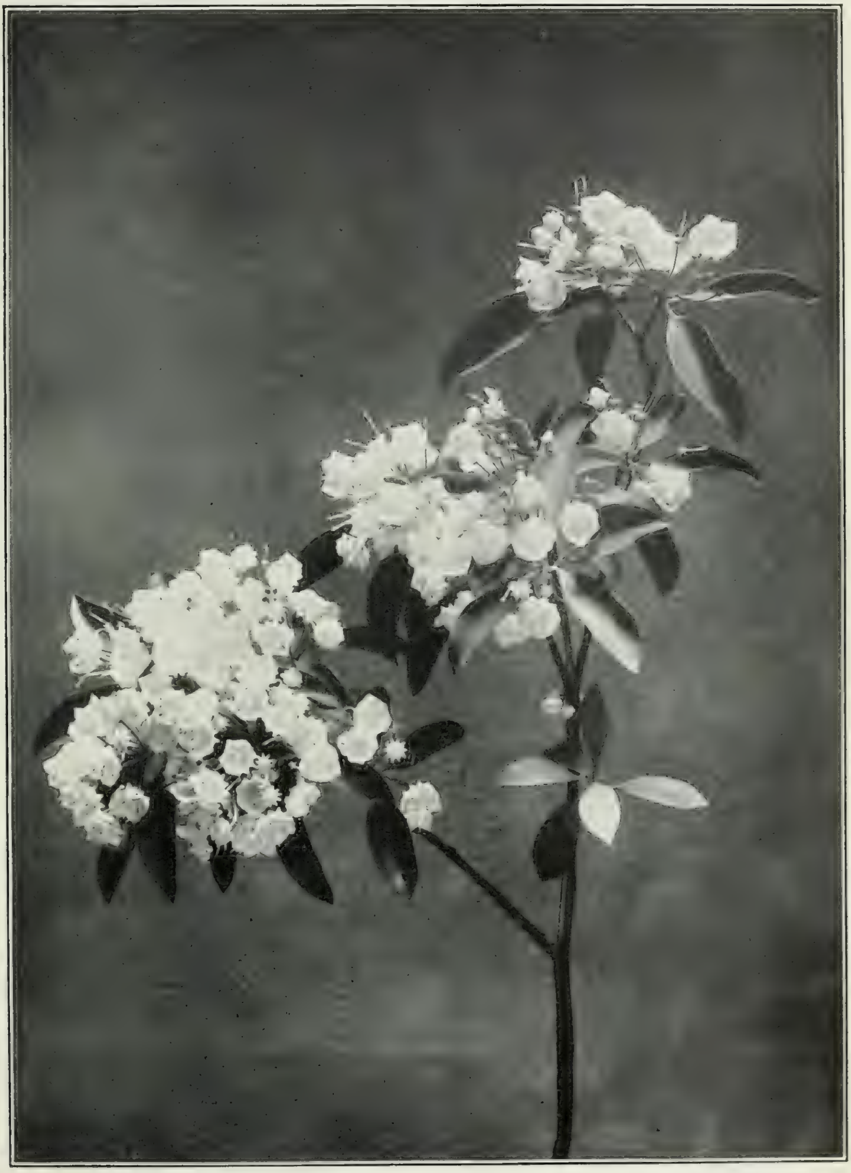
Vesque, Julien. Caractères des Principales Familles Gamopétales Tirés de l'Anatomie de la Feuille. Ann. des Sci. Naturel. Botan., 7th ser., vol. 1, p. 240, 1885.

Solereder, Hans. System. Anatom. d. Dicotyledonen, 1899, p. 541–551.

[g] Emerson, G. B. Trees and Shrubs of Massachusetts, vol. 2, p. 445, 1875.

[h] Browne, D. J. Trees of America, p. 364.

[i] Kalm, P., l. c., p. 264.



FLOWERING BRANCH OF MOUNTAIN LAUREL (KALMIA LATIFOLIA, L.).

Notices of this plant occur in the early botanies[a] and books of American travel. Capt. John Smith describes, in his Generall Historie of Virginia, 1624, volume I, page 10, a "Kinde of tree like Lowrell," while Hudson in 1609 mentions "rose trees" as occurring on Cape Cod. Catesby describes it under the name Chamaedaphne foliis tini, floribus bullatis umbellatis, and says distinctly that "When cattle and sheep, by severe winters deprived of better food, feed on the leaves of these plants, a great many of them die annually."[b] The Delaware Indians are said to have used a decoction of these leaves for suicidal purposes.[c]

Public attention was especially called to this plant by Peter Kalm, the Swedish botanist, after whom Linnæus named the genus Kalmia. He described it under the name "spoon tree," because the Indians at that time made spoons of this wood. During his travels in America in 1748 he noted that calves which had eaten of the leaves became "sick, swelled, foamed at the mouth, and could hardly stand," and reported from the observations of the colonists that sheep, especially young ones, died very quickly after eating of these leaves, and that horses, oxen, and cows were made sick but seldom died, as these animals ate only small quantities of the leaves. Deer and partridges were said to feed on the leaves with impunity, and the venison from these deer was harmless to man.[d] A snake was said to have been killed by dropping a tincture of this plant on its back.[e]

John Bartram, an early American botanist, was an ardent lover of, and writer on, mountain laurel, and by him it was brought to Collinson's attention, who then introduced it into England about 1734.[f] It would seem more appropriate to have named the genus after him,[g] as his work antedated that of Kalm. During General

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[a] Van der Donck, A. Vertoogh van Nieu Nederland, 1650. Translated by H. C. Murphy, 1854, p. 19.—Plukenet, L. Almagest. botan., 1769, p. 106; Almagest. botan. Mantissa, 1769, p. 49.—Gronovius, J. F., l. c., p. 160.—Linnæus, C. Spec. Plant., Ed. Willdenow, vol. 2, p. 600, 1799. Spec. Plant., vol. 1, p. 393, 1753. Amœn. Acad., vol. 3, p. 13, 1764.—Trew, C. J. Plantæ Selectæ, 1750, pl. 38. Ray, J. Hist. Plant., vol. 2, p. 1927, London, 1688. [Bannister's list of 1680.]—Hudson, H. Discourse. Collections of the New York Historical Society for the Year 1809, vol. 1, p. 121.

[b] Catesby, M. Natural History of Carolina, vol. 2, p. 98, 1743.

[c] Barton, B. S. Some Account of the Poisonous and Injurious Honey of North America. Amer. Phil. Soc. Trans., 1802, vol. 5, p. 61.

[d] Kalm, P., l. c., pp. 264–265.

[e] Barton, B. S. Collections for an Essay towards a Materia Medica of the United States, pt. 2, p. 27, 1804.

[f] Aiton, W. Hortus Kewensis, vol. 2, p. 64, 1789.—Catesby, M., l. c., p. 98.

[g] Darlington, W. Memorials of John Bartram and Humphry Marshall, pp. 130, 141, 228, etc., Philadelphia, 1849.—Bartram, John. Observations, London, 1751, pp. 26 and 69.

Braddock's campaign against the French and Indians in 1755 many horses[a] were lost from eating mountain laurel. The plant was introduced into France by Michaux.[b] In 1802 George G. Thomas[c] performed some experiments with *Kalmia latifolia* and *K. angustifolia* on himself, on a friend, and on some dogs. These experiments he embodied in an inaugural dissertation which was presented to the University of Pennsylvania. Six to 15 grains (0.4 to 1.0 gram) of the dried leaves produced distinctly unpleasant symptoms—rapid pulse, a feeling of fullness with pain in the head, throbbing of the temples, with nausea, vomiting, and dilatation of the pupils. In dogs the administration of a decoction of 30 grains (2 grams) was followed by marked salivation, with stupor, rapid respiration and purgation, paralysis, and finally convulsions. Thomas made the interesting observation that if the laurel was mixed with lard the toxic symptoms were much lessened. He examined the distillate from the leaves for an essential oil, but failed to find any.

After Thomas, several experimenters reported on the action of mountain laurel upon themselves. Bigelow,[d] who saw the dried leaves taken in doses up to 20 grains without producing symptoms, questioned if the leaves had a specific action, and traced any injurious effect they might exert to their indigestibility. Others, as Osgood,[e] Stabler,[f] and an anonymous author in the Boston Medical and Surgical Journal, volume 10, page 213, reported severe symptoms on themselves.

This action was compared with that of Veratrum.[g] From this time on few reports of experiments were published, yet the number of cases of poisoning in stock reported to the Department of Agriculture induced the Commissioner to call attention to this subject in his report of 1863.[h] Sheep are the animals usually reported as affected by the plant. Under ordinary conditions, however, eastern-bred sheep will not eat the plant unless they are starved or their supply of green or attractive food has been cut off.

As is well known, most of the cases of poisoning occur in winter,[i] when the laurel is the only green plant around, although western-bred sheep if suddenly turned into a laurel area may eat it at any time. As the leaves are tasteless and of a tough, leathery consistency, it is very evident why animals will not eat the plant under ordinary conditions.

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[a] Barton, B. S., l. c., p. 60.

[b] Browne, D. J. Trees of America, p. 364.

[c] Thomas, G. G. Inaugural Dissertation on the Kalmia Latifolia and Angustifolia, Philadelphia, 1802.

[d] Bigelow, J. Amer. Med. Bot., vol. 1, p. 140, 1817.

[e] Bigelow, J., l. c., vol. 3, p. 185, 1820.

[f] Stabler, R. H. On Kalmia Latifolia. Amer. Jour. Pharm., n. s., vol. 10, p. 241, 1845.

[g] Medical Properties of the Kalmia Latifolia. Boston Med. and Surg. Jour., vol. 10, p. 213, 1834.

[h] Report of the Commissioner of Agriculture for 1863, p. 242.

[i] Remarkable Instance of the Absence of Animal Instinct. Penny Magazine, vol. 7, p. 283, 1838.

A good illustration of actual poisoning is given by Rusby[a] where out of a flock of 1,000 sheep which escaped into a laurel area, at least 27 showed symptoms of poisoning. Those affected were mainly the young ones. In these cases the tracks on the snow around the bushes and the presence of leaves in the stomach showed conclusively the cause of the trouble. Halsted[b] reported poisoning in cows after eating laurel wreaths which had been thrown from a cemetery into their pasture. A striking case occurred in the National Zoological Park, Washington, D. C., where six Angora goats were poisoned by laurel thrown to them by visitors; later, a Diana monkey died with typical symptoms after eating the leaves held to it by a visitor. The leaves of the plant were found in the monkey's stomach. The post-mortem examination in this case was negative. Since these poisonings occurred visitors have been prohibited from carrying laurel into the park.

Barton in 1802[c] called attention to the fact that the honey made from *Kalmia angustifolia* was poisonous to man, and while no direct proof[d] has been published that honey made from *K. latifolia* is poisonous it is perfectly logical to suppose that it is, as Plugge found that honey made from *Rhododendron ponticum*,[e] a closely related plant, gave the same chemical and physiological tests on frogs and mice which he considers characteristic of its active principle, andromedotoxin. *Rhododendron ponticum* is the plant which is supposed to have yielded the honey which poisoned Xenophon's[f] army.

Under these circumstances the Secretary of Agriculture advised against raising bees in the neighborhood of mountain laurel. An unpublished report is on file at this office of investigations in which extracts of mountain laurel were mixed with honey and fed to bees.

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[a] Rusby, H. H. The Poisonous Properties of Mountain Laurel. Drug. Cir. and Chem. Gaz., vol. 46, p. 27, 1902.

[b] Halsted, B. D. Eighth Annual Report of the New Jersey Agricultural College Experiment Station for 1895, p. 355, 1896.

[c] Barton, B. S. Some Account of the Poisonous and Injurious Honey of North America. Amer. Phil. Soc. Trans., 1802, vol. 5, p. 59.

[d] American Bee Journal, 1896, pp. 92, 146, 246, 262.—Root, A. I. A B C of Bee Culture, p. 249.—Honey from Mountain Laurel. American Bee Journal, vol. 35, p. 825, 1895.

[e] Plugge, P. C. Giftiger Honig von Rhododendron ponticum. Arch. d. Pharm., vol. 229, p. 554, 1891.—Thresh, J. C. Notes on Trebizonde Honey. Pharm. Jour. and Trans., 1887–88, vol. 18, pp. 397, 404.

[f] Pliny. Nat. Hist. (Translated by Bostock and Riley), vol. 4, p. 341.—Abbott, K. E. Letter, in Proc. Zoolog. Soc. London, pt. 2, p. 50, 1834.

The name of the investigator can not now be ascertained. These bees are said to have shown no symptoms, but the honey they made produced typical symptoms in two persons who ate it.[a] It has been claimed that the flesh of birds after eating laurel is poisonous to man,[b] but Wilson,[c] Audubon,[d] and Aaron[e] state that they have frequently eaten without injury partridges whose craws were filled with laurel leaves and buds. It is probable that many of these cases of poisoning were really due to ptomaines, as they usually occurred from undrawn animals.

There are few cases in man of poisoning with laurel. Children are said to have been poisoned by eating the plant in mistake for *Gaultheria procumbens*,[f] although there are no published cases to that effect. Laurel is claimed to be used in certain liquors to render them more intoxicating.[g] Barton[h] noted that the flowers of *Kalmia latifolia* would produce a vesicular eruption in certain persons.

EFFECT OF MOUNTAIN LAUREL ON SHEEP.

Stable-fed sheep and lambs were turned into an inclosed area in which the mountain laurel was the only green plant. These sheep, which were kept under observation for several hours, refused to do more than merely nibble at the leaves, and when placed in grassy areas where this plant was growing they positively refused to touch it. These observations agree with those of Wood[i] on *Kalmia angustifolia*. Other animals besides sheep seem disinclined to eat it. Kalm reported in 1754 that the leaves of the trees in Pennsylvania were devoured by a worm, but that the mountain laurel leaves were untouched.[j]

Sheep weighing about 50 pounds (25 kilos) were fed with doses of 5, 10, 15, 25, and 35 grams of the dried ground-up leaves inclosed in gelatine capsules without producing poisonous symptoms. Fifty grams, when given to a sheep weighing 33.5 kilos, induced a staggering gait and slight salivation, but doses of 85 grams would cause death in a very few hours unless diarrhea set in. Under these conditions sheep have survived this dose. In starved animals no doubt smaller doses would be poisonous.

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[a] Unpublished answer to inquiry. See note on page 35.

[b] Barton, B. S., l. c., p. 60.—Elliot, D. G. "Game Birds" of the United States. Report of the Commissioner of Agriculture for 1864, pp. 363, 364, 1865.

[c] Wilson, A., and Bonaparte, C. L. Amer. Ornithology, vol. 2, p. 319, Edinburgh, 1831.

[d] Audubon, J. J. Birds of America, vol. 5, p. 79, 1871.

[e] Aaron, C. E. Cram's Magazine, vol. 2, p. 502, 1900.

[f] Unpublished correspondence. (G. Watkins, 1896.)

[g] Chesnut, V. K. Principal Poisonous Plants of United States. U. S. Dept. Agr., Div. Bot. Bul. 20, p. 45.

[h] Barton, B. S. Collections for an Essay Towards a Materia Medica of the United States, p. 35, 1804.

[i] Wood, T. F. Is Sheep Laurel Poisonous to Sheep? American Agriculturist, vol. 42, p. 66, 1883.

[j] Kalm, P., l. c., vol. 1, p. 266.

One experiment was with a sheep about 7 years old; weight about 22.5 kilos. On June 1, 1905, at 11:05 a. m., the temperature[a] was 104.5° F., respiration 60, pulse 90 per minute. A slight secretion from the nostrils was present owing to a coryza: pupils about one-fourth of an inch wide: the conjunctival, buccal, and mucous membranes normal. Eighty-five grams of powdered dried laurel leaves in sealed gelatine capsules were given. The feeding lasted twenty-five minutes.

Following the administration of the capsules little inclination to eat was manifested, urination and slight defecation taking place during the first hour. At 1 p. m., respiration was 110 per minute, pulse 117, temperature 104° F. Marked disinclination to move was shown, the sheep permitting itself to be easily turned on its side. It ate only sparingly. Two hours after taking the laurel leaves urination was repeated and slight emesis set in, followed soon by mental dullness, as shown by decreased attention to surrounding objects, with a loss of alertness, while the face took on a sleepy appearance and saliva began to accumulate about the mouth. Respiration was somewhat labored and the unsteadiness in gait became marked. Two and three-fourths hours after eating the laurel the sheep assumed an awkward attitude in standing, the hind legs being set wide apart. Repeated emesis became a prominent feature and continued for about an hour, the ejecta being thin and mustard-like. Apparently to facilitate breathing, the mouth was kept open most of the time. Weakness and unsteadiness increased until three and one-fourth hours after eating the laurel. At this time it was difficult for the animal to stand.

At 2:46 p. m. the temperature was 107° F., respiration 50 per minute, pulse 124. The pupils were of the same size as before the feeding. The abundant nasal secretion at this time became a very marked symptom, and continued so throughout the history of the case. Weakness increased until the animal could not stand, and a diminished sensitiveness to skin irritation was noted. Death ensued quickly at 3:06 p. m. No convulsions were noted at any time.

The post-mortem examination was made at once. The sheep appeared to be well nourished. Some mustard-colored ejecta were found in the trachea as well as in the bronchioles. The lungs crepitated markedly, but showed no special amount of fluid. The pleural cavity contained no increased amount of fluid. The mucous membranes were not discolored. The heart contained no clots, was not dilated, and contained only a little dark blood. The stomach was full of food and its walls showed no signs of irritation. The intestines were apparently congested, but showed no hemorrhages. The small intestines were more or less filled with thin normal-looking contents. The kidneys appeared normal, the bile was of a dark-green color, and the bladder was contracted and empty. The central nervous system was not examined.

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[a] In all cases the temperature was taken by the rectum.

The bile from this sheep, which amounted to about 20 c. c., was treated with alcohol, and after evaporating off the alcohol in vacuo was precipitated with lead acetate. The filtrate when freed from lead by H_2S and injected into guinea pigs produced absolutely no symptoms characteristic of laurel poisoning.

On May 22, 1905, one of the yearlings previously used, weighing 24.5 kilos (49 pounds), was fed with 90 grams of powdered dried laurel leaves in sealed gelatine capsules, the feeding beginning at 11:15 a. m. and taking about fifteen minutes. Before feeding, the pulse was 135, respiration 50 per minute, rectal temperature 103.9° F. After forty-five minutes an increased secretion of saliva became evident about the mouth and the sheep nibbled slightly at the grass. At 1:15 p. m. the temperature was 105° F., the head was held low, respiration was somewhat labored, and saliva ran profusely from the mouth; pulse 104, respiration irregular, 144 per minute, pupils unchanged. Two and a quarter hours after feeding, the animal became less active, the ears were held back, and the general aspect was that of a sheep half asleep. Respiratory and salivary symptoms continued, the animal standing with the hind legs wide apart and showing evidence of weakness in the hind quarters by a staggering gait.

Four hours after feeding, profuse nasal secretion became a conspicuous feature and weakness increased to such a degree that the subject was unable to stand; respiration 120, temperature 104° F. The nostrils were moist; pupils normal. Convulsions soon appeared, with sensitiveness to touch persisting in the conjunctiva; knee jerks active, pupils a trifle dilated. Ten minutes later emesis followed. Respiration was apparently increasingly difficult. The hind legs seemed stiff. At 3:50 p. m. the pulse was 104 per minute, temperature 103.8° F., with continued attempts at emesis and repeated tossing of the head from side to side; pupils normal. Death ensued at 9:30 p. m.

No discoloration of the mucous membranes was noted, and constipation prevailed during the period of observation. At no time was a marked thirst shown. The post-mortem examination made the following day showed the trachea injected and very moist and two or three teaspoonfuls of pure serum in the pleural cavity. The lungs were œdematous. The auricles were relaxed and filled with black clots; the left ventricle contained very little black blood, while the right ventricle contained very much more. The abdomen was distended with gas. The stomach was partially filled with food; the second and third stomach walls showed no special lesions, but the intestines throughout showed marked hemorrhagic enteritis. The small intestines contained very little solid matter, but there was some well-formed fecal matter in the cæcum. The liver was perhaps a trifle pale and the kidneys were slightly injected. The spleen showed no macroscopic change. In none of these cases was it possible to secure the urine for examination, as the bladder was found empty.

On October 14, 1905, a five-year-old (?) sheep, having a temperature of 101.8° F., at 1:20 p. m. was given 90 grams of fresh laurel leaves ground up and mixed with meal. The ration was practically all eaten at 3:20 p. m., when the temperature stood at 104° F. At 6 o'clock on the next morning a failure of appetite, together with slobbering, was noted. Numerous soft stools were found in the pen during the day. At 10:12 a. m. increased salivary secretion produced a frothy appearance about the mouth and the sheep held its head low. At 2:15 p. m. slight emesis and marked secretion of nasal mucus occurred accompanied by a temperature of 103.5° F. Twenty-five hours later the slobbering had ceased, but the appetite had not returned and the temperature stood at 102.9° F. Twenty-two hours later (1:45 p. m., October 17) the temperature was 103.5° F. and the animal seemed normal. The presence in the pen of numerous soft stools was noted. The sheep recovered.

EFFECT OF MOUNTAIN LAUREL ON RABBITS.

On February 6, 1905, a rabbit weighing 2,096 grams received hypodermically one drop of aqueous extract of laurel (1 gram of dried leaves in 3.75 c. c. of water). Further administrations were made as follows: February 13, 2 drops; February 21, 3 drops; February 25, 4 drops; February 28, 6 drops; March 3, 9 drops; March 7, 12 drops; March 10, 14 drops; March 22, 20 drops. On the last date evidence of laurel action appeared and a slight loss of appetite was noted. On March 30, 25 drops were administered as before, followed on April 5 by 30 drops. At this time the animal weighed 1,828.5 grams. At 9:19 a. m. the temperature was 100.9° F., the administration of the extract following three minutes later. The resulting events were as follows: 10:05 a. m., mouth moist; 10:50 a. m., convulsions; 11:15 a. m., could not stand; 11:55 a. m., could sit up in usual posture; 1:54 p. m., appeared normal. At 3:50 p. m. the temperature was 103.3° F. The animal lived about a year after the close of this investigation.

A rabbit weighing 1,559 grams, which had not received any previous injections, was given hypodermically at 9:54 a m., April 5, 1905, 30 drops of the extract used in the preceding case. The temperature five minutes before administration was 100.8° F. The following symptoms developed rapidly: After nine minutes, interference with the gait, followed shortly by urination and increasing evidences of weakness, with marked difficulty in standing, was noted; slight convulsions were seen 35 minutes after administration, repeated at intervals during the following hour and a quarter; at 11:15 a. m. paralysis of the hind legs led to a straddling attitude, head held back, and sphincter relaxed. The temperature at 11:50 a. m. was 95.2° F. At 1:54 p. m. the animal was much better. It could walk but staggered. At 3:49 p. m. the temperature was 102.3° F.; condition good. The rabbit seemed apparently all right until April 13, when convulsions occurred which were followed by death.

GENERAL SYMPTOMS OF POISONING.

The symptoms commonly observed are salivation, tearing, an increased flow of secretion from the nose, emesis with convulsions, and later paralysis of the limbs. On post-mortem examination the main macroscopic lesion is dilation of the vessels of the intestinal walls,[a] and if the case is not too acute, hemorrhages into the intestinal walls occur, resembling what is known as rhododendron poisoning. The aqueous extract of the flowers produced the same symptoms on rabbits as that made from the leaves.

ACTIVE PRINCIPLE.

Comparatively little chemical work has been done with mountain laurel save testing for a volatile oil [b] and arbutin.[c] Most of the chemical work has been done on a closely related plant, *Andromeda japonica*, now known as *Pieris japonica*. Eykmann [d] isolated an amorphous glucosidal body which he called asebotoxin, which melted at 120° C. and had a lethal dose for rabbits of 3 mg. per kilo. Plugge [e] studied the same plant, making his first report in 1882. He extracted the plant with water, then precipitated with lead acetate and lead subacetate, and after removing the lead with sulphureted hydrogen or sodium sulphate concentrated the fluid in vacuo at 50° C. This colorless fluid was then shaken out with chloroform, and the chloroform on evaporation left transparent, noncrystalline scales, which he called andromedotoxin. The mother liquid gave an amorphous body, andromedorubrin. This andromedotoxin gave no precipitates with alkaloidal reagents and did not reduce Fehling's solution, but gave certain color reactions and produced distinct and characteristic symptoms on injection into guinea pigs and frogs—severe retching, which, however, is absent after large doses; disturbances of respiration; convulsions, and paralysis.

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[a] In one case of poisoning by *Andromeda polifolia*, this was noted by Plugge. Ueber d. Vorkommen d. Andromedotoxins in Andromeda Polifolia. Arch. d. Pharm., vol. 221, p. 814, 1883.

[b] Stabler R. H. On Kalmia Latifolia. Amer. Jour. Pharm., n. s., vol. 10, p. 246.—Bullock, C. On Kalmia Latifolia. Amer. Jour. Pharm., n. s., vol. 14, p. 260, 1848.

[c] Kennedy, G. W. Arbutin in Kalmia Latifolia. Amer. Jour. Pharm., vol. 47, p. 5, 1875.

[d] Eykmann, I. F. Sur le Principe Toxique de l'Andromeda Japonica. Rec. d. Travaux Chim. des Pays-Bas, vol. 1, p. 224, 1882. Phytochem. Notizen u. einige japan. Pflanzen. Abhandl. d. Tokio Daigaku, No. 10, p. 1, 1883.

[e] Plugge, P. C. Ueber Andromedotoxin. Arch. d. Pharm., vol. 221, p. 1, 1883.

The characteristic color reactions are as follows:

(1) Concentrated sulphuric acid gives a dark reddish brown color and dissolves it gradually. On warming it becomes a deeper red. On dilution with water this passes into a light mulberry-red, disappearing with alkalis returning with H_2SO_4.

(2) Evaporation with dilute H_2SO_4 (1:5) on water bath causes rose-red color. If the body is pure there is no odor, but if not pure there is an odor of ericinol, due to the decomposition of ericolin, an attached body.

(3) Dilute HCl acts the same as H_2SO_4, only it gives a color more nearly violet-red.

(4) Dilute phosphoric acid, 25 per cent, gives a mulberry-red color. By this means 0.0000005 gram of andromedotoxin can be recognized.

Especial emphasis is laid on the second and fourth reactions.[a] Plugge also extended his studies to other members of this group. The first of these to be examined was *Andromeda polifolia*. He made the plausible claim that because the chloroform "shaking" from the aqueous extract freed from extraneous matter by lead gave the same color reactions and produced the same action in animals as that from *Pieris japonica* it contained the same active principle, but he admitted that this body was much less active than the andromedotoxin obtained from *Pieris japonica*. He explained this weakness as being due to the fact that the plant was grown on a different soil and that the active principle varied from that of *Pieris japonica* much as the active principle of the various species of Digitalis and Aconitum vary.[b]

In using this method with *Leucothoë catesbaei*[c] Plugge noted that the first six or seven chloroform shakings gave an amorphous residue, while the seventh to the ninth gave a white crystalline body from which he obtained the characteristic physiological action and color reactions of andromedotoxin.

From *Chamaedaphne calyculata* he obtained some crystalline deposit, but in this case from the lack of material was unable to positively identify it as crystalline andromedotoxin. The material obtained from this plant was less active physiologically than that obtained from *Pieris japonica*. Crystals were also obtained from *Azalea indica*.

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[a] Plugge, P. C. Vorkommen von Andromedotoxin in verschied. Ericaceen. Arch. d. Pharm., vol. 223, p. 906, 1885.

[b] Plugge, P. C. Ueber d. Vorkommen d. Andromedotoxin in Andromeda Polifolia. Arch. d. Pharm., vol. 221, p. 818, 1883.

[c] Plugge, P. C. Vorkommen von Andromedotoxin in verschied. Ericaceen. Arch. d. Pharm., vol. 223, p. 905, 1885.

In 1887 Plugge[a] and his pupil de Zaayer[b] made a more extended study of the andromedotoxin obtained from *Rhododendron ponticum*. They summed up the previous chemical work and studied the active principle pharmacologically. They claimed that the body shaken out by the chloroform could be precipitated from alcohol or chloroform solution by ether in the form of crystalline needles. Muto failed to obtain these needles from *Pieris japonica*, the plant Plugge first worked with. This body contained carbon, hydrogen, and oxygen, but no nitrogen, and melted at 228° to 229° C. Plugge and de Zaayer gave it the empirical formula $C_{31}H_{51}O_{10}$, although the figures for this conclusion were not exact. It was readily soluble in water and alcohol, but very slightly in ether. They stated that it was more soluble in cold than in hot water, although Plugge elsewhere states the opposite. In water, alcohol, and amyl alcohol it turns the plane of polarization to the left, while dissolved in chloroform it turns it to the right. It gives no precipitate with alkaloidal reagents. When subcutaneously injected, 0.0001 gram caused death in a frog (*Rana temporaria*) in a few hours.

This conjoint paper apparently so settled the question as to indicate that all that was necessary to determine the presence of andromedotoxin was to ascertain if the chloroform shaking from the plants gave the same physiological action and the same color reaction as that described for andromedotoxin. Plugge did this with *Kalmia latifolia* and from its action on frogs decided that the fluid extract contained one-half of 1 per cent of andromedotoxin. By this method he decided that andromedotoxin was present in the following plants:

Pieris japonica Thunb.
Andromeda polifolia L.
Leucothoë catesbaei (Walt.) Gray.
Chamaedaphne calyculata (L.) Moench.
Rhododendron grande Wight.
Rhododendron barbatum Wall.
Rhododendron fulgens Hook. f.
Rhododendron cinnabarinum Hook. f.
Rhododendron puniceum Roxb.
Rhododendron ponticum L.
Rhododendron chrysanthum L.
Rhododendron hybridum Ker.
Rhododendron falkoneri Hook. f.
Rhododendron maximum L.
Kalmia latifolia L.
Kalmia angustifolia L.
Azalea indica L.
Monotropa uniflora L.
Pieris formosa Don.
Pieris ovalifolia Don.

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[a] Plugge, P. C. Ueber Andromedotoxin. Arch. d. Pharm., vol. 221, p. 12, 1883.

[b] Zaayer, H. G. de. Untersuch. ü. Andromedotoxin. Arch. f. gesam. Physiol., vol. 40, p. 480, 1887.—Plugge, P. C. Andromedotoxin. Verhandl. d. X internat. med. Cong., vol. 2, pt. 4, p. 28, 1891.

Plugge concluded that andromedotoxin was the active principle of the Ericaceæ in general.

In the case of *Rhododendron hirsutum*, Plugge[a] found that the chloroform shaking failed to produce any immediate symptoms in frogs, but three hours after injection convulsions with slight respiratory disturbance occurred, with the secretion of mucus from the mouth. These symptoms completely disappeared, differing from those of andromedotoxin. This extract gave no reactions with dilute or concentrated HCl, 25 per cent phosphoric acid, and dilute H_2SO_4. In studying the distribution of andromedotoxin, Plugge makes the interesting observation that concentrated solutions of *Erica vulgaris*, now known as *Calluna vulgaris*, injected subcutaneously into frogs cause symptoms resembling those of andromedotoxin poisoning, yet chemically no trace of this body could be found.[b]

Lasché also studied the action of extracts of *Kalmia latifolia* and *K. angustifolia* on animals, and corroborated Plugge's data, but isolated no pure body and made no chemical analysis. He used the berries in his work.[c]

Matusow,[d] while accepting the belief that andromedotoxin is the active principle of the leaves, says that the chemical reactions of the root correspond with those of andromedotoxin, except with hydrochloric acid. He claims the presence of calcium, magnesium, aluminum, manganese, and iron in the roots.

Archangelsky[e] examined another member of the Ericaceæ, the *Rhododendron chrysanthum*, a native of Siberia, and isolated a crystalline principle, rhododendrin, with the empirical formula $C_{16}H_{22}O_7$, which was inactive to frogs, and a crystalline body, rhododendrol, which acted on frogs similarly to camphor. He also claimed the presence of andromedotoxin, but did not isolate it. He examined *Rhododendron ponticum* and obtained the same color reactions and physiological reactions found by Plugge with andromedotoxin.

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[a] Plugge, P. C. Andromedotoxinhaltige Ericaceen. Arch. d. Pharm., vol. 229, p. 553, 1891.

[b] Plugge, P. C. Fortgesetzte Untersuch. ü. d. Verbreit. d. Andromedotoxins in d. Familie d. Ericaceen. Arch. d. Pharm., vol. 27, p. 171, 1889.

[c] Lasché, A. J. M. Examination of Some of the Poisonous Ericaceæ of North America. Pharm. Rund., vol. 7, p. 208, 1889.

[d] Matusow, H. Analysis of the Root of Kalmia Latifolia. Amer. Jour. Pharm., vol. 69, p. 341, 1897.

[e] Archangelsky, K. Ueber Rhododendrol, Rhododendrin und Andromedotoxin. Arch. f. exper. Path. u. Pharm., vol. 46, p. 313, 1901.

Hayashi and Muto failed to obtain crystalline andromedotoxin from *Pieris japonica* by using Plugge's method.[a]

So it can not be said that the active principle from mountain laurel has been actually isolated in a pure state. Using Plugge's method, the writer failed to obtain active crystals from mountain laurel, but obtained crystals by a different method, namely, from the filtrate after ether precipitation. Plugge's principle is precipitated by ether. In no case has the writer found the ether precipitate physiologically active, and an ether extract of the crude plants possessed the toxic action of the plant. Full details as to the chemical and pharmacological investigations will be made later.

Laboratory animals, as guinea pigs and rabbits, after subcutaneous injection show tearing, retching, convulsions, and later paralysis. This physiological reaction can be used as a guide in the isolation of the active principle. Before death in males there is an ejection of semen.

REMEDIAL AGENTS.

The fact that sheep which have diarrhea have recovered from toxic doses of mountain laurel would suggest purgative treatment. Farmers very commonly administer lard in this condition, and this no doubt acts by hindering absorption. The use of lard in laurel poisoning has been substantiated by the experiments of Thomas, who found that the animals were less likely to become poisoned if lard was administered. In case vomiting and purgation do not occur, this result should be encouraged by the usual agents.[b] To induce vomiting, 60 milligrams of apomorphine hydrochlorate may be given subcutaneously and purgation may be encouraged by giving 2 to 6 ounces (60 to 180 grams) of epsom salts dissolved in water as a drench. The treatment is purely symptomatic and no true antidote is known.

It seems of interest to ascertain whether the action on the glandular secretion noted can not be obtained free from great toxicity by a change in the chemical structure of the active principle.

MEDICINAL ACTION.

Thomas treated one case of diarrhea by means of a decoction of *Kalmia latifolia*, and the leaves have also been used empirically in the treatment of certain stages of fever. Locally an ointment has been employed for various forms of skin diseases, such as tinea, etc., but now it has fallen entirely out of use. A tincture is still used by homeopathic physicians.[a] The only indications for its use would be as a substitute for some member of the veratrine or aconitine family.

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[a] Hayashi, H., and Muto, K. Ueber Athmenversuche mit einigen Giften. Arch. f. exper. Path. u. Pharm., vol. 47, p. 220, 1902.

[b] Remarkable Instance of the Absence of Animal Instinct. Penny Magazine, vol. 7, p. 283, 1838.

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[a] Boericke and Tafel. Amer. Homeop. Pharm., 1896, p. 279.

NOTE.—*Kalmia angustifolia* is used by the Cree Indians as a tonic. Bul. Torrey Bot. Club, vol. 12, p. 53, 1885.

NOTE TO THE SECOND EDITION.—Since the publication of this article it has been learned that the leaves used by the experimenter referred to on page 26, footnote *a*, were examined by Prof. Victor K. Chesnut, whose card catalogue was found very useful in preparing the historical portion of this paper, and he identified them as those of oleander and not of mountain laurel.

B. P. I.—340.

RESULTS OF LOCO-WEED INVESTIGATIONS IN THE FIELD.[a]

By C. DWIGHT MARSH, *Expert, Poisonous-Plant Investigations.*

FIELD WORK.

The word "loco," from the Spanish, meaning crazy, has been applied for a great many years to a disease of stock and sheep in the semiarid region of the West. There has been a general belief among stockmen that the disease is caused by certain weeds known as loco weeds. The name loco weed has been applied to a large number of plants, but two are considered especially obnoxious—*Aragallus lamberti* and *Astragalus mollissimus*.

More or less desultory investigations by scientific men have been made on this subject, the general result of which has been to imply that the disease was produced by some other cause than the loco plants. The later investigations have made it seem quite probable that the cause of the disease must be sought in some other direction. The investigations here recorded were undertaken to clear up first of all the doubt concerning the source of trouble.

The first essential point was to demonstrate whether the loco weeds did or did not cause the disease. The work of the first season, the summer of 1905, accomplished this demonstration in a very satisfactory way. It was clearly proved that *Aragallus lamberti* would poison horses, sheep, and cattle and that *Astragalus mollissimus* would poison horses. *Astragalus mollissimus* does not poison cattle because they very rarely eat it.

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[a] For many years stockmen of the plains east of the Rocky Mountains have reported great losses due to a somewhat undefined cause known as "loco." It has been estimated that the losses from this source in Colorado alone have reached the sum of a million dollars per annum. A thorough investigation of the loco problem by the Bureau of Plant Industry, both in its field and laboratory aspects, was undertaken by the office of Poisonous-Plant Investigations, under the direction of Dr. Rodney H. True, Physiologist in Charge, the field work being in the hands of Dr. C. Dwight Marsh, Expert, and the laboratory work in those of Dr. Albert C. Crawford, Pharmacologist.

The importance of the results obtained, together with the fact that the publication of the rather extensive evidence accumulated is likely to be somewhat delayed, has made it seem desirable to present at once a brief summary of the results obtained.—B. T. GALLOWAY, *Chief of Bureau.*

The work of the second season, the summer of 1906, was mainly devoted to a diagnosis of the disease. The external symptoms described by stockmen were in general corroborated. The principal symptoms are the lowered head, rough coat, slow, staggering gait, movements showing lack of muscular coordination, sometimes more or less paralytic symptoms, a generally diseased nervous system, and in the later stages of the disease extreme emaciation.

The principal pathological changes are pronounced anemia of the whole system, diseased stomach walls, and in acute cases a congested condition of the walls of the stomach, while in chronic cases there are frequently ulcers. Generally speaking, locoed cattle have ulcers in the fourth stomach. There is an excess of fluids in the various cavities of the body. This is especially noticeable in the epidural space of the spinal canal. Here the effusion is more or less organized, presenting the appearance of a gelatinous mass, which is especially abundant in the lumbar region and about the exits of the spinal nerves. In most locoed females the ovaries are found in a diseased condition.

The third stage of the work was the devising of remedial measures. This was undertaken in the summer of 1907. This work naturally had two phases, (1) attempts to eradicate the weed and (2) attempts to cure the locoed animals.

In regard to the possibility of killing the weeds, it was found that this could readily be done in the case of fenced pastures. This is especially feasible with *Astragalus mollissimus*, because it occurs in comparatively small patches. *Aragallus lamberti* has a wider distribution, but it is not at all impossible to destroy this weed when in pastures. There seems to be no way of ridding the ranges of these weeds, however.

In regard to the second phase of remedial work, it was found that locoed cattle can in most cases be cured by a course of treatment with strychnine, while locoed horses can generally be cured by a course of treatment with Fowler's solution. The animals under treatment must not be allowed to eat the loco weed and should be given not only nutritious food but, so far as possible, food with laxative properties. To this end magnesium sulphate was administered to correct the constipation which is almost universal among locoed animals. It should be noted, too, that magnesium sulphate may serve to some extent as an antidote to the poison.

It may be added, in regard to the question of immunity, that loco poisoning comes on in a slow and cumulative manner, so that there is no possibility of animals becoming immune.

LABORATORY WORK ON LOCO-WEED INVESTIGATIONS.

By Albert C. Crawford, *Pharmacologist, Poisonous-Plant Investigations.*

SUMMARY OF LABORATORY WORK.

(1) Conditions analogous to those found in locoed animals occur in portions of the world other than the United States, especially in Australia.

(2) The symptoms described in stock on the range can be reproduced in rabbits by feeding extracts of certain loco plants. Those especially referred to here under the term "loco plants" are *Astragalus mollissimus* and *Aragallus lamberti.*

(3) The production of chronic symptoms in rabbits is a crucial test of the pharmacological activity of these plants.

(4) It is the inorganic constituents, especially barium, which are responsible for this poisonous action, at least in the plants collected at Hugo, Colo.; but perhaps in future loco plants from other portions of the country may be found to have other poisonous principles.

(5) There is a close analogy between the clinical symptoms and pathological findings in barium poisoning and those resulting from feeding extracts of certain of these plants. Small doses of barium salts may be administered to rabbits without apparent effect, but suddenly acute symptoms set in analogous to those reported on the ranges.

(6) The administration of sulphates, especially epsom salts, to form insoluble barium sulphate would be the chemical antidote which would logically be inferred from the laboratory work, but of necessity these sulphates would have to be frequently administered, and their value after histological changes in the organs have occurred remains to be settled. But the treatment of acute cases of barium poisoning in man is not always successful, even when sulphates combined with symptomatic treatment are employed. The conditions under which sulphates fail to precipitate barium must be considered.

(7) Loco plants grown on certain soils are inactive pharmacologically and contain no barium. In drying certain loco plants the

barium apparently is rendered insoluble, so that it is not extracted by water, but can be extracted by digestion with the digestive ferments. To be poisonous the barium must be in such a form that it can be absorbed by the gastro-intestinal tract.

(8) In deciding whether plants are poisonous it is desirable to test not merely the aqueous or alcoholic extract, but also the extracts obtained by digesting these plants with the ferments which occur in the gastro-intestinal tract.

(9) It is important that the ash of plants, especially of those grown on uncultivated soil, as on our unirrigated plains, be examined for various metals, methods similar to those by which rocks are now analyzed by the United States Geological Survey being used.

(10) It is desirable to study various obscure chronic conditions, such as lathyrism, with reference to the inorganic constituents of the Lathyrus and other families of plants.

B. P. I.—341.

THE SOURCES OF ARSENIC IN CERTAIN SAMPLES OF DRIED HOPS.[a]

By W. W. Stockberger, *Expert, Drug-Plant Investigations.*

INTRODUCTION.

For several years considerable attention has been given in England to the question of the origin of the arsenic sometimes found there in beer.[b] Some students of the question have pointed out glucose,[c] malt,[d] and hops[e] as possible sources of this substance. The occasional detection of minute quantities of arsenic in dried hops has furthered the belief that hops should be carefully examined for traces of this undesirable substance, a view which finds partial support in some experiments made with hops dried by each of the two processes used in England.[f] In one of these, known as the "direct" process, the hops are dried over open fires and are thus exposed to all the combustion products arising therefrom. In the other, or "indirect" process, a current of pure heated air is caused to pass through the hops, which do not come into direct contact with the gases or fumes from the fires. From the experiments cited the conclusion is drawn that hops dried by the indirect process are arsenic free.[a]

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[a] The growing and curing of hops has been a subject of investigation in the Bureau of Plant Industry during the past two years by the office of Drug-Plant Investigations, under the direction of Dr. Rodney H. True, Physiologist in Charge. The execution of the work in both field and laboratory has been chiefly in the hands of Dr. W. W. Stockberger, Expert. In connection with these investigations, that phase concerning the occurrence of arsenic in hops has been touched upon with fruitful results, which are here summarized. Since the conclusions reached have an important bearing on matters of considerable economic importance, their immediate publication is deemed desirable.—B. T. Galloway, *Chief of Bureau.*

[b] Royal Commission on Arsenical Poisoning, London, 1901–1903. Report of the Medical Officer of Health for the City of London, No. 86.

[c] Windisch, W. Wochenschr. f. Brauerei, vol. 18, p. 30, 1901.—Hantke, E. Letters on Brewing, vol. 1, pp. 16–21, 1901.—Petermann, A. Ann. Sci. Agron., vol. 2, p. 396, 1901.

[d] Chapman, A. C. Analyst, vol. 26, p. 10, 1901.—Fairley, T. Analyst, vol. 26, p. 177, 1901; Pharm. Jour., vol. 65, pp. 634, 738, 1900.

[e] Baker, J. L., and Dick, W. D. Jour. Soc. Chem. Ind., vol. 23, p. 174, 1904.

[f] Duncan, C. County Analyst's Annual Report to the Worcestershire County Council, 1905, Appendix I, pp. 22–24.

It is known, however, that traces of arsenic sometimes occur in hops which have been dried by the indirect process, a condition which has been urged in England as an argument against the purchase of imported hops, thus rendering more difficult the sale abroad of those grown in the United States.

Since under the ordinary conditions of hop production in the United States there is a surplus which requires an annual exportation of a considerable portion of the crop,[b] it is highly desirable that this product be prepared in every way free from deleterious substances which would interfere with its sale and use abroad.

During a recent study of the processes of curing and sulphuring hops[c] some experiments were made to determine the most probable source of arsenical contamination. The possible sources include fuels, arsenical sprays, the soil, and sulphur both when used in the field to destroy pests and when burned under the hops on the kiln during the drying process.

Since the open-fire, or "direct," process of drying is never used in this country, and as traces of arsenic have been found in hops not treated with insecticides, only the soil and sulphur were considered in these experiments, which, though not fully complete, have yielded results of so much importance to American hop growers that they are here presented in preliminary form.

ORIGIN OF SAMPLES OF HOPS EXAMINED.

The geographical distribution of hops containing traces of arsenic was first investigated. Dry commercial samples were obtained from England, Belgium, East Prussia (Altmark), Bavaria, Bohemia (Saaz), British Columbia, New York, Wisconsin, and the Pacific coast. Upon analysis[d] small quantities of arsenic (1.5 parts to the million, or less) were detected in samples from each of the regions just mentioned. These results indicate that hops from any of the hop-growing districts of the world may contain traces of arsenic, and suggest the necessity for the thorough examination of hops whatever their geographical origin, as well as the desirability of a careful scrutiny of the methods of cultivation and curing used abroad, particularly those processes in which, contrary to the American practice, hops are dried over open fires.

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[a] Duncan, C., loc. cit., p. 24.

[b] Merritt, E. Bul. 50, Bureau of Statistics, U. S. Dept. Agriculture, table 5, p. 13.

[c] Stockberger, W. W. Farmers' Bulletin No. 304, U. S. Dept. Agriculture, 1907, pp. 19-26.

[d] Except when otherwise stated all analyses for arsenic were made in the Bureau of Chemistry, United States Department of Agriculture.

EXAMINATION OF HOP SOILS.

Samples of soil from a number of American hop fields have been examined for arsenic,[a] but in no case has its presence been detected. However, these results do not necessarily prove the absence of arsenic from the soils of the fields examined, since the hop plant has a very extensive and deep-growing root system which might very readily explore soil layers unrepresented in the samples taken.

Since traces of arsenic have been found in unsulphured hops grown on some of the soils from which these samples were taken, it may be inferred that the samples were not representative of the true soil conditions as just noted or that arsenic may be present in the soil in quantities too minute to be detected by the ordinary methods of analysis, the larger and measurable quantity in the plant being due to gradual accumulation during the process of growth.

THE ABSORPTION OF ARSENIC BY THE GROWING PLANT.

Some early authors held that living plants did not absorb arsenic,[b] but numerous plants have been found to contain this substance,[c] which was doubtless derived from the soil. Nobbe[d] states that only a very small quantity of arsenic is taken up by plants, though according to Angell[e] plants of rhubarb, bean, rye, and buckwheat accumulate appreciable quantities from soils heavily fertilized with superphosphates. Davy[f] found arsenic in peas, cabbages, and Swedish turnips grown in soils mixed with superphosphates, 40 per cent of which Lyttkins[g] states contain arsenic, in amounts varying from 0.012 to 0.26 per cent as estimated by Stoklasa.[h] Collins[i] found that barley grown on soils containing arsenic may accumulate large amounts of this element, most of which, as has been further shown by pot experiments,[a] occurs in the barley grains. Likewise, Gosio[b] records the accumulation of arsenic in the leaves, stems, and fruits of squash plants which had been watered with dilute arsenic solutions.

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[a] The analysis of the soil samples was made in the Bureau of Soils, United States Department of Agriculture.

[b] Targioni-Tazzetti, A. Ann. Sci. Nat., ser. 3, vol. 5, pp. 177–191, 1846.—Danberry, Chas. Quart. Jour. Chem. Soc., vol. 14, pp. 209–230, 1862.

[c] Pfeffer, W. Pflanzenphysiologie, 2 ed., vol. 1, pp. 432–433, 1897.

[d] Nobbe, F., Baessler, P., and Will, H. Landw. Versuchstat., vol. 30, p. 409, 1884.

[e] Angell, A. and A. F. Chem. and Drug., vol. 60, p. 430, 1902.

[f] Davy, E. W. Philos. Magazine, vol. 18, pp. 108–113, 1859.

[g] Lyttkins, A. Kgl. Landw. Akad. Handl., vol. 33, pp. 317–320, 1894.

[h] Stoklasa, J. Ztschr. Landw. Versuch. Oesterr., vol. 1, p. 154, 1898.

[i] Collins, S. H. Jour. Soc. Chem. Ind., vol. 21, pp. 222–223, 1902.

In order to test the capability of the hop plant to take up arsenic from the soil, two adjoining plats of sixty hills each were selected in a hop yard and from May 24 to August 5, 1907, the alternate hills of one plat were watered weekly with solutions of arsenious acid and those of the other with solutions of arsenic acid. Each solution was made up in five different strengths, the arsenious acid ranging from 0.01 to 1 per cent and the arsenic acid from 1 to 3 per cent. Solutions of each acid were then applied to fifteen groups of two hills each in amounts so regulated as to form a gradually increasing series. In this way the total amount of arsenious acid administered to the plants of each hill ranged from one-tenth of an ounce to 24 ounces and the arsenic acid from 2 to 20 ounces to each hill. When the hops were mature, those from each group of two hills which had received the same treatment were gathered separately, dried without sulphur, and prepared for chemical examination.

Upon analysis traces of arsenic, from 0.5 to 3 parts per million, were found in each sample examined. While the amount of arsenic in various samples was not in direct proportion to the amount administered to the plant, the balance of evidence is in that direction. Necessarily the experimental error is very large, but when due allowance is made for it the results warrant the conclusion that hops will take up from soils containing available arsenic amounts relatively proportional to the quantity contained therein.

IMPURE SULPHUR AS A SOURCE OF ARSENIC.

That the sulphur used in sulphuring hops frequently contains small quantities of arsenic is quite generally known and has been suggested as the source of the arsenic occasionally found in dried hops.[c] However, analysis of the different grades of sulphur in common use indicates that from the quantities applied in most cases sufficient arsenic would not be produced to account for the traces sometimes found in hops, provided it was uniformly distributed through them. Analysis shows that there is often wide variation in the amount of arsenic contained in samples drawn from different bales of the same lot in which all the hops were grown and dried under practically the same conditions, and also in samples drawn from different portions of one and the same bale.

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[a] County Councils Cumberland, etc. Tech. Education Rept., vol. 10, pp. 1–121, 125–150, 1901.

[b] Gosio, B. Atti r. Accad. Lincei, vol. 15, pp. 730–731, 1906; abstract in Centbl. Bak. Par. u. Infek., part 2, vol. 18, pp. 724–725, 1907.

[c] Rüffer, E. Wochenschr. f. Brauerei, vol. 18, p. 109, 1901.

This apparent contradiction may be explained on the assumption that the arsenic volatilized by the burning of the sulphur is deposited on the layers of hops next the floor of the kiln while the upper layers remain practically free. To test this theory, a series of experiments was made with a small kiln in which different lots of hops were separately exposed to the fumes of equal amounts of the different grades of sulphur, after which samples were carefully taken from the top and bottom layers before the hops were removed. The experiment was repeated with double the quantity of each grade of sulphur used before. For comparison, a certain quantity of arsenious oxid was added to the sulphur, with which a final lot was treated.

The preliminary results of these experiments fully support the theory that arsenic may be transferred from sulphur to hops and unequally distributed therein. The analysis of the samples shows in practically every case a very appreciable difference between the amounts of arsenic deposited in the upper and lower layers of the hops. The evidence further indicates that the greater portion of the arsenic is deposited in the bottom layer. The variation in the results obtained with the different grades of sulphur was less than was anticipated, since each grade apparently increased materially the arsenic content of the hops.

Although each test was repeated, using double the amount of sulphur, the relative proportion of arsenic present was not constant. However, the results indicate that a larger arsenic content may be expected when the proportion of sulphur used is increased.

The samples from the last experiment, in which arsenious oxid (the white arsenic of commerce) was added to the sulphur, contained relatively large quantities of arsenic, twelve times as much being found in the hops of the bottom layer as in those of the top layer.

CONCLUSIONS.

From the foregoing experiments the following conclusions are drawn:

(1) Traces of arsenic may occasionally be found in dried hops irrespective of their geographical origin.

(2) If available arsenic is present in the soil it may be taken up by the hop plant under favorable conditions.

(3) Except in rare cases the amount of arsenic derived from the soil by the hop plant is probably smaller than 0.01 grain per pound of dry hops, which is the smallest amount regarded as deleterious by the Royal Commission on Arsenical Poisoning in England.

(4) By the use of impure sulphur during the process of curing, hops may be contaminated with arsenic, which will be concentrated in the lower layers on the kiln floor with the result that certain samples may show an amount greater than 0.01 grain per pound.

(5) The probability of hops acquiring arsenic from what seems to be a very ready source may be much lessened by employing only the very highest grades of purified sulphur in hop curing, and the quantity used should be reduced to the lowest possible limit.

B. P. I.—342.

APPLE LEAF-SPOT CAUSED BY SPHAEROPSIS MALORUM.

By W. M. Scott, *Pathologist*, and James B. Rorer, *Assistant Pathologist, Investigations of Diseases of Fruits.*

INTRODUCTION.

The disease of apple leaves known as "brown-spot," "frog-eye," "leaf-blight," or "leaf-spot" is very common throughout the eastern United States. As these names suggest, the disease is characterized by circular or irregular reddish brown spots with slightly raised purplish margins. (Pl. III, fig. 1.) These spots when first visible to the naked eye are very minute and purple, but rapidly increase in size until they attain a diameter of from one-eighth to one-half inch, while the affected tissue becomes brown and later sometimes gray. The mature spots are usually circular, but after midsummer may become more or less irregular or distinctly lobed in outline, a condition apparently brought about by a secondary extension of the disease from two or more points on the margin of the original circular spot. If the infection is bad, a number of spots may coalesce and form large brown patches involving half the leaf or more, but in these dead areas the margins of the individual spots usually remain distinct.

These spots should not be confused with those produced on apple leaves by the apple-blotch Phyllosticta. The latter are yellowish and minute, never more than one-sixteenth of an inch in diameter, and will not be considered in this paper.

Leaf-spot is of greater economic importance than is generally supposed. It makes its first appearance early in the spring as the leaves are unfolding, and infections take place continuously throughout the growing season. As a result of its attacks trees may become completely defoliated from six weeks to two months before the normal period of leaf fall. If this is repeated for a series of years, the trees become weakened and the life of the whole orchard is materially shortened. Moreover, the fruit from such prematurely defoliated trees is small and of poor quality, and the fruit buds must necessarily go into the dormant stage in a rather immature condition, often resulting in a partial or complete failure of the next year's crop.

CAUSE OF LEAF-SPOT.

Considerable confusion has existed as to the cause of this leaf-spot disease. Though no inoculation experiments have been reported, the disease has generally been conceded to be of fungous origin and has commonly been attributed to *Phyllosticta pirina* Sacc., and less commonly to *Phyllosticta limitata* Pk. and *Sphaeropsis malorum* Pk., while species of Hendersonia, Pestalozzia, and other fungi have been reported as occurring on the diseased areas.

The disease in its economic aspect was first mentioned by Alwood[1] [a] in 1892, when he described a "brown-spot" of apple foliage and reported a serious outbreak in the Virginia orchards during the preceding summer. He attributed the trouble doubtfully to *Phyllosticta pirina.*

In 1895 Kinney[2] cited the same fungus as the cause of apple and pear leaf-spots in Rhode Island.

Stewart,[3] in 1896, reported a serious outbreak of leaf-spot on Long Island caused by an undescribed fungus which Peck named *Phyllosticta limitata.*

In 1898 Alwood[4] again recorded the common occurrence of *Phyllosticta pirina* on leaf spots, but found *Sphaeropsis malorum* Pk. and *Hendersonia mali* Thüm. associated with it.

Lamson,[5] in 1899, gave *Phyllosticta pirina* as the cause of "brown-spot" of apple foliage in New Hampshire, while Corbett,[6] in 1900, described a "brown-spot," or "frog-eye," in West Virginia due to the same fungus.

In 1902 Stewart and Eustace[7] questioned the parasitism of *Phyllosticta pirina* and *P. limitata.* In their opinion "at least a large part of the so-called apple leaf-spot is due to spray injury and weather conditions and not to fungous origin." They suggest that the fungi in question live saprophytically on leaves injured by Bordeaux mixture and arsenical sprays, or in the case of unsprayed trees on leaf-spots which are in some way the result of atmospheric influences. A possible explanation for the formation of the spots is "when a shower is followed by bright sunshine, drops of water on the leaves act as lenses and concentrate the sun's rays to such an extent as to overheat the tissues underneath."

In 1902 Clinton[8] recorded *Sphaeropsis malorum* as the cause of brownish spots on apple leaves in Illinois "much like those of the

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[a] The serial numbers used in this paper refer to the bibliography, which will be found on page 54.

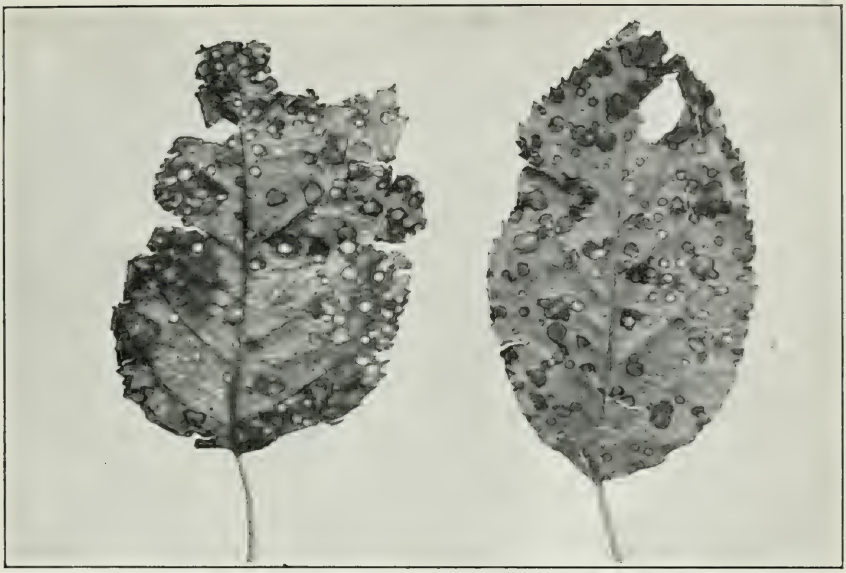

FIG. 1.—APPLE LEAVES SHOWING LEAF-SPOTS PRODUCED BY NATURAL INFECTION.

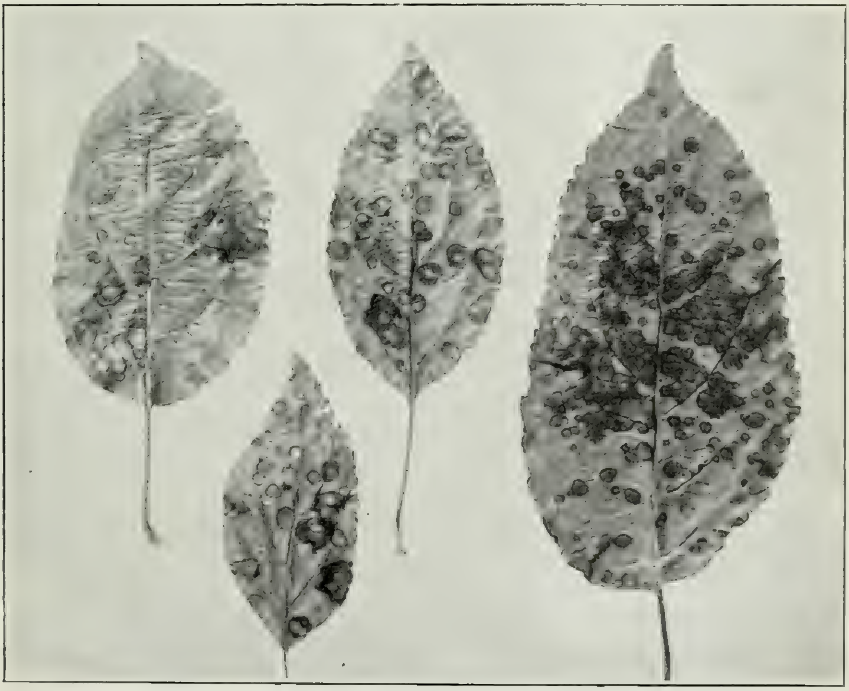

FIG. 2.—APPLE LEAVES SHOWING LEAF-SPOTS PRODUCED BY INOCULATION WITH SPHAEROPSIS MALORUM, PK.

leaf-spots or Phyllostictae fungi, but are apt to be more irregular and larger." The same author,[9] in 1903, stated that most of the apple leaf-spot troubles in Connecticut were due to this same fungus.

Stone and Smith,[10] 1903, in accounting for a serious outbreak which occurred in Massachusetts the previous year say "there can be no reasonable doubt that frost was the destructive agency." They observed that the spotting of the leaves continued throughout the summer, and that even as late as August spots as a result of spring frost developed on leaves which had not previously shown the injury.

Sheldon,[11] in 1907, transferred the fungus *Phyllosticta pirina* Sacc. to the genus Coniothyrium on account of the dark color of the spores and proposed the name *Coniothyrium pirina* (Sacc.) Sheldon. From an examination of herbarium material and fresh specimens from different parts of the eastern United States there is no doubt that the fungus commonly called *Phyllosticta pirina* in this country is a Coniothyrium. Apparently mature spores from a European specimen of *Phyllosticta pirina* in the herbarium of the Department of Agriculture are hyaline and ellipsoid, agreeing with the original description of Saccardo,[12] so that his species may prove to be autonomous.

In view of the conflicting statements and apparent uncertainty as to the cause of apple leaf-spot, the writers during the summer of 1906 and 1907 made a study of the disease in connection with demonstration spraying work in the Ozarks. It was found that *Sphaeropsis malorum*, contrary to the general belief, is the cause of the disease.

CULTURAL STUDIES.

A somewhat cursory examination of a large amount of leaf-spot material collected in Arkansas during 1906 showed that there was no one fungus which fruited constantly on the spots. The pycnidia of *Coniothyrium pirina* (Sacc.) Sheldon were found perhaps more commonly than any other, but two species of Pestalozzia and one each of Coryneum, Hendersonia, and Alternaria occurred frequently, while occasionally the pycnidia of *Sphaeropsis malorum* and a species of Septoria were met with. The same was true of specimens received from Missouri, Nebraska, New York, Maryland, Virginia, and West Virginia. Pure cultures of all of these fungi were easily obtained by the poured-plate method. All grew well and fruited abundantly on apple agar or sterilized apple wood.

In the early part of the season of 1907 cultures were obtained from leaf spots by a somewhat different method. During the first spring outbreak of the disease, spots of various sizes, together with a little of the surrounding healthy tissue, were cut from the leaf and placed in a solution of mercuric chlorid (1–1,000) for two or three minutes. The bits of leaf were then thoroughly washed in sterile water and transferred to slanted apple or potato agar. The writers separately made many sets of cultures by this method, using spots from leaves of Ben Davis, Winesap, and White Pearmain trees. Within a few days by the aid of a hand lens hyphæ could be seen growing out from the center or margins of the small spots. Mycelium developed rapidly and in about two weeks spores were formed, so that the fungi could be identified. The results were uniformly the same. In all cases in which the youngest spots, that is, those one-sixteenth of an inch or less in diameter, were used, the fungous growth was a pure culture of *Sphaeropsis malorum* Pk. In cultures made from the older spots, in which the central tissue had become brown, sometimes a pure Sphaeropsis was obtained, but more often a mixture of things. *Coniothyrium pirina* developed about as commonly as Sphaeropsis, both species often growing from the same spot. In addition to these two fungi, two species of Alternaria, a Cladosporium, bacteria, and yeasts were frequently present.

This cultural work, frequently repeated, gave evidence that *Sphaeropsis malorum*, always developing from the youngest spots, was the specific cause of the disease and that the other organisms were mere concomitants. Of course, to prove this inoculation experiments were necessary. These were made as soon as pure fruiting cultures of the different fungi were obtained.

INOCULATION EXPERIMENTS.

A number of different sets of inoculations were made, but the method of procedure was the same in each case. With a sterile needle the fruiting fungus was scraped from the surface of the agar and transferred to a tube of sterile water. In cases where pycnidia were present these were crushed against the side of the tube with a sterile glass rod to set free the spores. In order to ascertain the presence of mature spores a hanging drop of the fluid was always examined microscopically. This spore-bearing liquid was then sprayed on both surfaces of clean young leaves with an atomizer. Trees in more or less isolated young orchards were selected, and no two fungi were used on the same tree. From 20 to 40 leaves on two or three different shoots were involved in each inoculation. Checks were always made on separate trees by spraying 40 or 50 leaves with sterile water.

The first inoculations were made on May 28, 1907. The fungi used were *Sphaeropsis malorum*, and the undetermined species of Coryneum, Hendersonia, and Alternaria previously mentioned. It was raining at the time and the weather continued wet for several days.

On June 3, 1907, purple specks were appearing on the leaves which had been inoculated with Sphaeropsis, and on June 18 these leaves were badly affected with leaf-spot. (Pl. III, fig. 2.) On a twig bearing 30 leaves, 12 showed a dozen or more well-developed spots, and a few of these leaves had from 80 to 90 spots each. Twelve other leaves on the same branch had from 2 to 10 spots each, while only 6 remained free from the disease. On another branch 12 out of 20 leaves were badly affected.

With the exception of an occasional spot, evidently resulting from natural infection, the leaves sprayed with spores of the other fungi, as well as those sprayed with sterile water as a check, remained free from the disease.

Another experiment was made on June 19, 1907. Spores of *Sphaeropsis malorum*, *Coniothyrium pirina*, Coryneum, and Alternaria were used. The work was done at sunset following a shower, so that the leaves were wet. Again the leaves inoculated with the spores of *Sphaeropsis malorum* soon became badly affected with the characteristic leaf-spot disease, while the others, including the checks, developed no more than an occasional spot.

Another test was made with Sphaeropsis alone. The young leaves of a 2-year-old tree were inoculated during a period of dry weather in mid-June. The spores were sprayed on the leaves at about 10 o'clock, while the sun was shining brightly. At the same time sterile water was sprayed on the leaves of an adjacent tree as a check.

Though no rain fell for at least six days after the spraying was done, numerous purple specks began to appear on the inoculated leaves within a week and soon developed into the characteristic brown spots. A few spots, never more than one to a leaf, appeared on the checks. The mature spores of Sphaeropsis germinate so rapidly that in dry weather the dews provide sufficient moisture for leaf infection, as indicated by this experiment.

Inoculations made on June 26, 1907, with *Sphaeropsis malorum*, Coryneum, and Alternaria gave results similar to those previously recorded for these fungi. From 20 to 50 spots developed on each of the leaves inoculated with Sphaeropsis, while only a few scattered spots occurred on the leaves of the check and on those sprayed with spores of the other fungi.

On August 4, 1907, inoculations with Coniothyrium were again tried. Leaves on rapidly growing 2-year-old Ben Davis trees in a nursery were used. The spores were obtained from a fresh culture and were so numerous that they clouded the liquid. The work was done during a light shower and some rain fell the next day.

The same experiment was repeated on the evening of August 14, 1907. Though it did not rain at this time the trees were wet down with sterile water on the following night.

Again, on August 21, 1907, this same fungus was used for inoculations, which were made in the evening just after a heavy rain. For the next two days the sky was overcast and occasional showers fell.

The results of these three sets of inoculations with Coniothyrium were negative. Spots were found here and there on the inoculated leaves, but no more than on the checks which were sprayed with sterile water. Similar spots, never more than two to a leaf, were found throughout the nursery at this time and were evidently produced by a natural infection with Sphaeropsis.

CONCLUSIONS.

The following conclusions may be drawn from the results of the inoculation experiments described in the preceding pages:

Sphaeropsis malorum Pk., the black-rot fungus, is parasitic on apple leaves, producing circular (or irregular) reddish brown spots an eighth of an inch or more in diameter, and is undoubtedly the cause of the apple leaf-spot disease which occurs in the middle West. The common apple leaf-spot disease of the Eastern States, being so similar in every respect, is doubtless caused by the same fungus, although some other fungi may possibly produce similar spots.

Coniothyrium pirina (Sacc.) Sheldon, although it occurs abundantly on apple leaf-spots, appears to have nothing to do with their formation.

The several other fungi that were tested, such as *Hendersonia* sp., *Coryneum* sp., *Pestalozzia* sp., and *Alternaria* sp., proved to be nonparasitic in these experiments and probably occur on leaf spots only as saprophytes.

SOURCE OF INFECTION.

Sphaeropsis malorum is perhaps the most common fungus that inhabits pome-fruit orchards east of the Rocky Mountains. It is the cause of the black-rot of the apple, the pear, and the quince and produces cankers on trunks and branches of these fruit trees. It occurs abundantly on dead twigs and branches in nearly every orchard, producing spores in enormous numbers. This is perhaps the most fertile source of infection for both fruit and foliage. In old orchards, particularly where pruning is neglected, the leaf-spot disease is much worse than in young orchards. The leaves of young trees adjacent to an old orchard become more spotted with the disease than those farther removed. Another source of infection is the diseased fruits of the previous year's crop. Although the fungus fruits only sparingly on leaves on the tree, it produces fertile pycnidia in considerable numbers on these leaves after they have fallen to the ground.

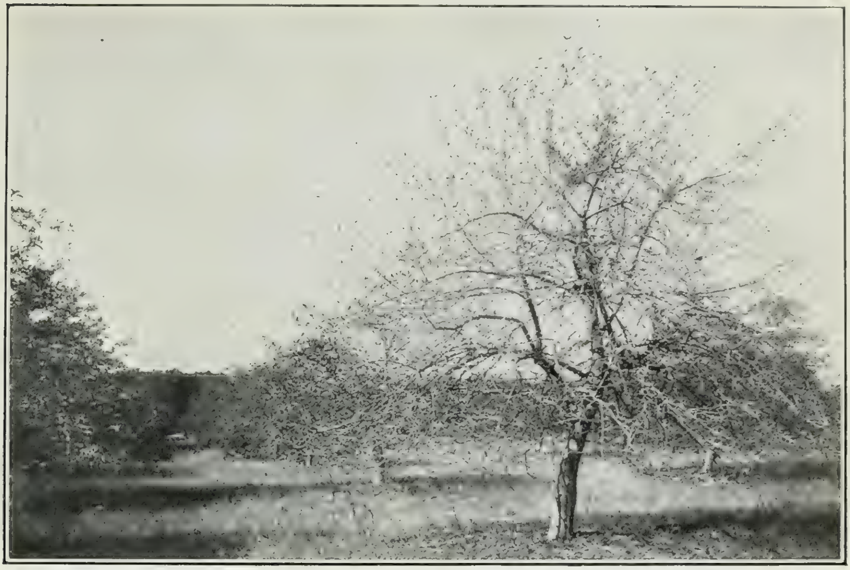

FIG. 1.—UNSPRAYED WINESAP TREES DEFOLIATED BY THE LEAF-SPOT DISEASE.

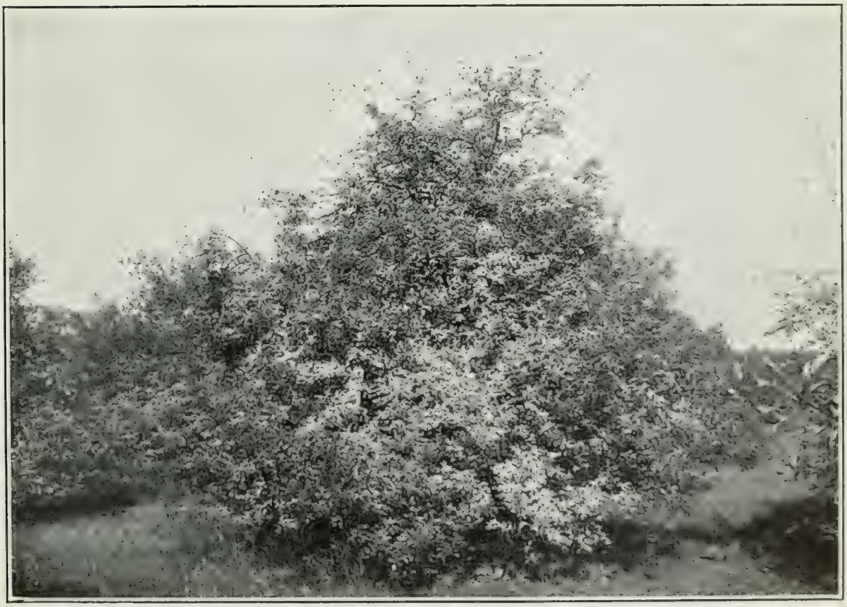

FIG. 2.—SPRAYED WINESAP TREES IN FULL FOLIAGE, LOCATED IN THE SAME ORCHARD AND PHOTOGRAPHED AT THE SAME TIME (OCTOBER 19, 1906) AS THOSE SHOWN IN FIGURE 1.

TREATMENT.

Since 1892, when Alwood[13] first recommended Bordeaux mixture as a preventive for apple leaf-spot, other writers have advocated the same method of treatment. The prevention of this disease has been one of the most striking results of various spraying experiments and demonstrations conducted by the Bureau of Plant Industry. Waite, in 1901, in connection with bitter-rot experiments in Virginia, controlled the disease with two applications of Bordeaux mixture. His recommendations in Farmers' Bulletin No. 243, p. 19, are based upon this work. Similar results were obtained by Scott[14] in Virginia in 1905. In the spraying demonstrations in the Ozarks during 1906 and 1907 the writers found that the spraying ordinarily necessary for the protection of the fruit from fungous attacks[a] will usually control this leaf trouble without any additional treatment. During both seasons unsprayed trees were shedding their leaves by August 1 and were completely defoliated by the middle of September, while the sprayed trees remained in full foliage until the first killing frost. (Compare Pl. IV, figs. 1 and 2.) In addition to the injurious effect upon the trees this premature defoliation caused the fruit to be small and of poor quality as compared with that from sprayed trees. An average barrel of Winesaps from sprayed trees contained 612 apples, while 731 from unsprayed trees in adjacent rows were required to fill a barrel.

For the control of this disease alone, without reference to the diseases of the fruit, an application of Bordeaux mixture should be made in the spring a week or ten days after the petals have fallen, a second application four weeks later, and a third about four weeks after the second. Three applications are necessary only in exceedingly wet seasons in sections where the disease is severe. Ordinarily two treatments, one about three weeks after the petals are off and the other four or five weeks later, are sufficient.

A weak Bordeaux mixture, such as 3 pounds of copper sulphate and 3 pounds of lime to 50 gallons of water, is effective in controlling this disease, Bordeaux mixture of full strength not being required.[b]

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[a] For a combination treatment for the leaf-spot disease, the diseases of the fruit, and the codling moth, see Farmers' Bulletin No. 283, pp. 41–42.

[b] For various formulas and methods of preparing Bordeaux mixture, see Farmers' Bulletin No. 243, pp. 5–10.

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B. P. I.—347.

THE IMMUNITY OF THE JAPANESE CHESTNUT TO THE BARK DISEASE.

By HAVEN METCALF, *Pathologist in Charge of the Laboratory of Forest Pathology.*

THE EXTENT OF THE BARK DISEASE.

The bark disease of the chestnut, caused by the fungus *Diaporthe parasitica* Murrill, has spread rapidly from Long Island, where it was first observed, and is now reported from Connecticut, Massachusetts, Vermont, New York as far north as Poughkeepsie, New Jersey, Pennsylvania, and possibly Delaware. It is no exaggeration to say that it is at present the most threatening forest-tree disease in America. Unless something now unforeseen occurs to check its spread, the complete destruction of the chestnut orchards and forests of the country, or at least of the Atlantic States, is only a question of a few years' time.

AN IMMUNE VARIETY.

Observations made by the writer during the past year indicate that all varieties and species of the genus Castanea are subject to the disease except the Japanese varieties (*Castanea crenata* Sieb. and Zucc.). All of the latter that have been observed in the field or tested by inoculations have been found immune. This fact can hardly fail to be of fundamental importance to the future of chestnut nut culture. Although the nuts are distinctly inferior in flavor to the European varieties, such as Paragon, the Japanese chestnut is already grown on a large scale as a nut-producing tree. There are, however, many trade varieties of dubious origin. Some of these may prove later to be subject to the disease. Immunity tests of all known varieties of chestnuts have been undertaken.

Attempts will also be made to hybridize the Japanese with American and European varieties, with the hope of combining the immunity of the former with the desirable qualities of the latter.

However excellent as a nut and ornamental tree, the value of the Japanese chestnut as a forest tree is doubtful. It can be recommended only experimentally at present for forest planting. It certainly will not take the place of the American chestnut. The tree is said to attain a height of 50 or 60 feet in Japan. As seen in this country it is a handsome tree, dwarfish and compact in habit, and rather slow growing. It has hardly had time to show how large it can grow.

The immunity of the Japanese chestnut, together with the fact that it was first introduced and cultivated on Long Island and in the very locality from which the disease appears to have spread, suggests the interesting hypothesis that the disease was introduced from Japan. So far, however, no facts have been adduced to substantiate this view.

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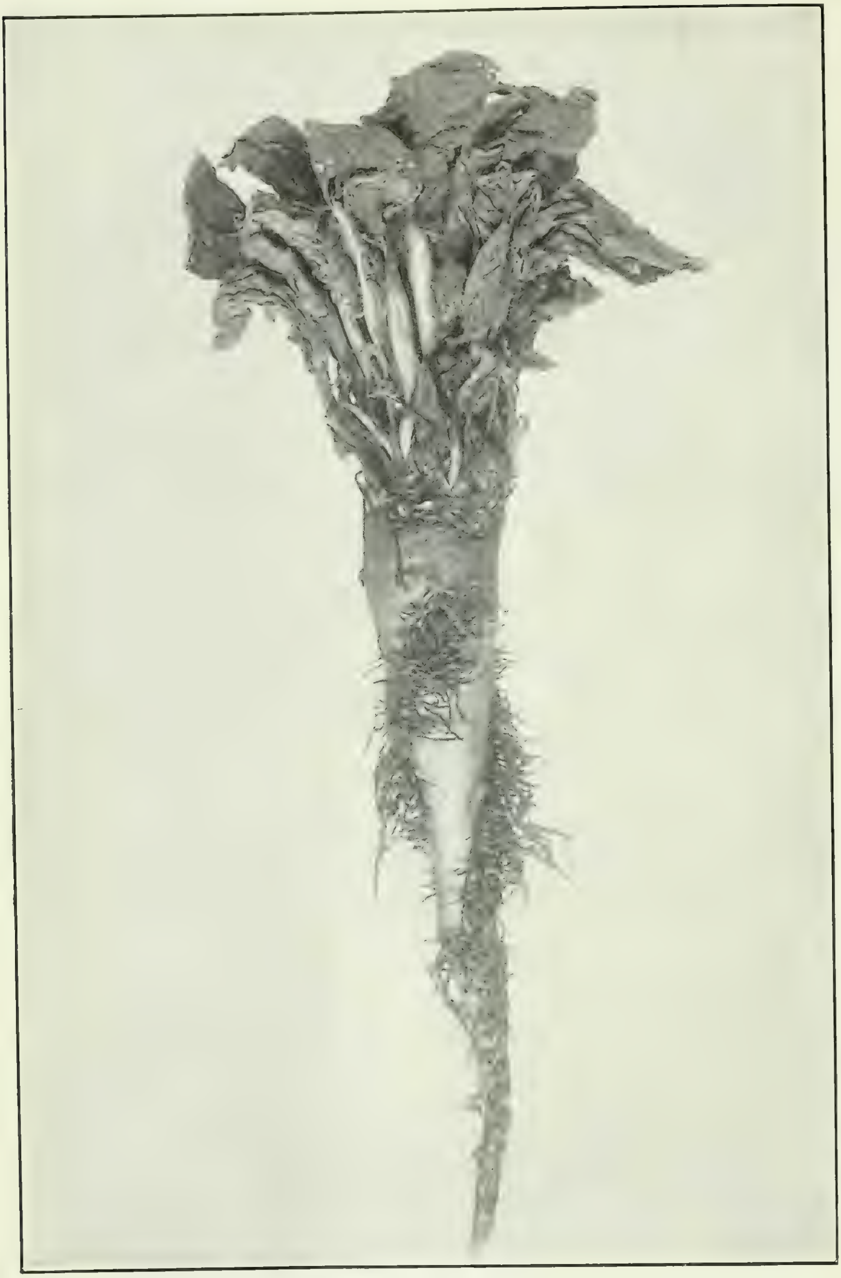

A SUGAR BEET FOUR MONTHS OLD AFFECTED WITH CURLY-TOP.

(Natural size.)

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 122.

B. T. GALLOWAY, *Chief of Bureau.*

CURLY-TOP, A DISEASE OF THE SUGAR BEET.

BY

C. O. TOWNSEND,

Pathologist in Charge of Sugar-Beet Investigations.

Issued April 25, 1908.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., January 28, 1908.

Sir: I have the honor to present herewith the manuscript of a bulletin entitled "Curly-Top, a Disease of the Sugar Beet," by Dr. C. O. Townsend, Pathologist in Charge of the Sugar-Beet Investigations of this Bureau. I recommend that it be published as Bulletin No. 122 of the Bureau series.

The bulletin presents the results of the investigations and observations by this Bureau during the past six years. It deals with one of the most destructive diseases of the sugar beet, and while the results obtained thus far are in the main negative, the object in presenting them at this time is twofold: (1) To encourage the growers of sugar beets by showing them that the presence of this disease in their locality during a certain season is not an indication that it has become a permanent factor in the cultivation of sugar beets in that locality, and (2) to assist other experimenters and observers in their efforts to find the real cause of the disease by bringing together the results of what has already been done by this Bureau to that end, thus preventing useless repetitions. It is the purpose to continue the investigations along all possible lines that promise a solution of the problem until the exact cause of curly-top is known and a satisfactory remedy for its control discovered.

Respectfully,
B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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CURLY-TOP, A DISEASE OF THE SUGAR BEET.

SYMPTOMS OF CURLY-TOP.

The external characters or symptoms of curly-top are to be found in all parts of the diseased plant. The leaves that develop after the beets become affected with curly-top are very much smaller and more numerous than normal leaves, and the petioles are very short. The leaf blades are both shorter and narrower than normal leaves and are decidedly crinkled and puckered. (Compare Pls. I and II and figs. 1 and 2 of Pl. III.) On the under side of the leaf blade are many elevations, giving the surface a rough appearance. (Pl. III, fig. 1, and Pl. IV, fig. 1.) The leaves are more or less packed together as compared with a normal beet and the crown is decidedly broadened, as shown in Plates I and II. The roots of beets affected with curly-top are usually hairy, but this character, although nearly constant and distinct, is somewhat variable, being frequently more or less marked than Plate I and Plate VIII, figure 1, would indicate.

In regard to the internal characters or symptoms of curly-top, the tissues of the leaves or leaf stems show a distortion of the cells. (Pl. IV, figs. 1 and 2.) A comparison of figures 1 and 2, Plate V, will show the marked alternation of light and dark rings in the cross section of the diseased root, the fibro-vascular bundles being darkened throughout its entire length, as shown in Plate VI, figure 1. The roots are more or less fibrous or woody and pass through the slicers with difficulty, often causing the knives to clog. There is no decay or softening of the tissue in any part of the plant, except as indicated below.

In addition to the constant symptoms—curled leaves more or less roughened below, thickened crown, hairy roots, dark fibro-vascular bundles, and tough woody roots—there are some other symptoms that frequently accompany the constant curly-top characters, but which are not sufficiently constant to be considered symptoms of curly-top. These may be known as conditional symptoms, since their presence depends upon conditions of growth and environment.

One of these conditional symptoms is the stunted appearance of the diseased beets, which becomes apparent if the disease attacks the beets before they reach their full size. This nondevelopment of the beets is often looked upon as one of the chief indications of curly-top.[a] If the beets are full grown before they are attacked by curly-top they will have all the symptoms of the disease, but necessarily can not be stunted in the sense of being below the normal size. Not only may beets have curly-top without being stunted, but they may be stunted by withholding the water necessary for their development, as shown in Plate X, figure 2, or by subjecting them to other abnormal conditions of growth without producing any of the constant curly-top symptoms.

Curly-top beets sometimes have a wilted appearance as if suffering from lack of moisture. This symptom does not always appear, especially in those cases of curly-top that develop after the middle of the growing season, while in any case the wilted appearance of the leaves is not marked until the season is considerably advanced. Moreover, perfectly healthy beets present a wilted appearance when the interval between rains or between irrigations is too long. The outer leaves wilt first in both instances, but in the case of the diseased leaves the wilting is not necessarily accompanied by a drying out of the soil, and the addition of water will not restore the diseased beets to their normal condition.

Another almost constant character, but one that is not confined to curly-top beets, is the presence of a dark spot in the interior of the crown, as shown in Plate VI, figure 1. A cavity frequently develops in this spot, as shown in the figure referred to. The tissue in the darkened spot does not usually decay, although it becomes somewhat softened and either shrinks or fails to develop with sufficient rapidity, thus forming the cavity. A cavity similar in appearance, apparently due to too rapid growth, forms in healthy beets.

OCCURRENCE OF CURLY-TOP.

Of the various diseases of the sugar beet, two have been more or less destructive in this country for several years. One is the eastern blight, or leaf-spot disease, due to the fungus *Cercospora beticola* Sacc.; the other is the so-called western blight, or curly-top, the cause of which has not been definitely determined. The latter disease only will be considered in this bulletin.

Curly-top has been a subject of observation and study by the writer in the field, in the laboratory, and in the greenhouse for the past six years. It seems to have been known for many years in this country. Doctor Hedgcock, of this Bureau, states that he saw distinct cases of curly-top in garden beets in Nebraska more than twenty years ago.

---

[a] Smith, Ralph E. Beet-Blight Investigation. Report of the Plant Pathologist to July 1, 1906. Bulletin No. 184, California Agricultural Experiment Station, p. 240.

There is no record, however, of a serious outbreak of curly-top until the summer of 1900, when it appeared simultaneously in several widely separated sugar-beet areas in the western portion of the United States. In each of these localities it did considerable damage. Since that time it has been more or less destructive in one or more sugar-beet sections each year.

Curly-top has never been reported with certainty from any other country in which sugar beets are grown, and in this country it seems to be confined almost exclusively to the central and western portions of the sugar-beet belt. It has been studied in Indiana by Arthur, Golden, and Cunningham. It has never been observed by the writer east of the Mississippi River, and while it has been seen in practically all of the sugar-beet States west of the Mississippi River, there are localities in several of these States where sugar beets have been grown for five years or more in which a case of curly-top has never been observed.

Curly-top is not confined to any particular variety of beets. It has been observed on garden beets (red beets) and on stock beets (mangel-wurzels), as well as on all strains of sugar beets. As a rule it is more common, however, on sugar beets than on stock or garden beets. Even in those localities where curly-top is very severe on sugar beets, it has been observed that the stock and garden beets suffer comparatively little from the disease. A striking exception to this rule was found in 1907 in our experimental field at Garland, Utah, in which certain plots of garden beets contained a higher percentage of curly-top beets than could be found in any of our sugar-beet plots in the same field.

Plate VIII shows some of the garden beets affected with curly-top compared with healthy beets from the same row. Curly-top outbreaks are not limited to those sugar-beet areas in which alkali is most abundant in the soil, nor entirely to the irrigated portions of the sugar-beet belt. Curly-top is not usually found in all the fields in any given area, even when it is very serious in that locality. Frequently adjacent fields are attacked by this disease in very different measure. Even a given field is not equally affected in all parts, as shown in Plate IX, figure 1. Furthermore, in the same row beets are not all attacked to the same degree, and frequently we find diseased and healthy plants standing but a few inches apart. (See Pl. IX, fig. 2.)

Young plants seem to be most easily attacked by curly-top, but it is not uncommon for beets that are full grown to develop symptoms of this disease. Sometimes second-year beets that are apparently perfectly healthy when selected in the fall show signs of curly-top during the second season. Its appearance on the stems of seed beets is strikingly shown in Plate XI. The main stem shown in this plate was trimmed for single-germ seed and then covered with paper and cloth bags in the manner described in Bulletin No. 73 [a] of the Bureau of Plant Industry, the young shoots showing curly-top that developed under these conditions.

When the outbreak is very serious, new cases occur from day to day or from week to week throughout the season. The large majority of cases developing in any locality during a given season, however, make their appearance before the plants are one-half grown, and frequently more than 50 per cent of the cases found in a given field occur before the beets are a quarter of their normal size.

NAMES OF THE DISEASE.

This peculiar disease of the sugar beet has received so many different names in different localities that considerable confusion has resulted. It has been known as the California beet disease, a bacterial disease of the sugar beet, bacteriosis, bacterial gummosis, blight, western blight, stunted beets, whiskered beets, hairy-root, and curly-top.

Owing to the fact that this disease of sugar beets first appeared to an alarming extent in California, it was called the "California beet disease." This name was soon abandoned, however, as what appeared to be the same disease was found in several other States that year (1900), and since that time it has appeared with certainty in seven of the sugar-beet States. In 1890 Professor Huston, chemist of the Agricultural Experiment Station of Indiana, noticed an abnormal appearance of certain beet samples that he was preparing for analysis.[b] These beets were examined by Dr. J. C. Arthur, of the same station, who found large numbers of bacteria in the diseased specimens, and the disease was consequently designated as a bacterial disease of the sugar beet.

In 1891 Miss Golden published the results of her investigation in regard to this and other diseases of the sugar-beet root found in Indiana.[c] She isolated an organism found in beets having abnormally curled and twisted leaves and made inoculations into a small number of healthy plants. Four out of six of the inoculated beets developed leaves similar in appearance to the original beets from which the organism had been obtained. It is to be regretted that such a small number of inoculations into healthy plants was made, since this is one of the crucial points in determining the cause of a supposed bacterial disease.

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[a] Townsend, C. O., and Rittue, E. C. The Development of Single-Germ Beet Seed. Bulletin No. 73, Bureau of Plant Industry, March, 1905.

[b] Huston, H. A. Sugar Beets. Bulletin No. 39, part 2, Purdue University Agricultural Experiment Station, 1892, p. 49.

[c] Golden, Katherine E. Disease of the Sugar-Beet Root. Proceedings of the Indiana Academy of Science, 1891, p. 92.

Another report on this disease was published by Professor Arthur and Miss Golden in 1892.[a] The presence of bacteria in great numbers in the diseased beet was again verified, but whether they were the real cause of the disease was not clearly established. Some portions of the description and the figures given would seem to indicate curly-top, but the great abundance of the organisms and the ease with which they could be seen and isolated would, on the other hand, seem to distinguish it from the disease which forms the subject of this paper, at least with reference to the cause or causes which produce the curly-top symptoms. Furthermore, Miss Golden states on page 93 of the article above referred to, describing the disease under investigation by her, that "during the early growth of the plants no difference can be seen between the diseased and healthy ones, but as they develop, the outer leaves of the diseased plants wither, while the heart leaves curl up much more than the normal, are dull in color, and the under side has a mottled appearance, causing the leaves to resemble somewhat those of the Savoy cabbage."

According to the writer's observations of the curly-top disease, the center or youngest leaves are the first to show the disease by their curled and puckered appearance. If the disease appears early in the life of the plant all the leaves may be affected, as shown in Plate III, figure 1. The leaves do not usually become dull in color and the outer ones do not necessarily wither or even wilt in the first stages of the disease, although they sometimes wilt and frequently become a few shades duller as the disease progresses. When examined by transmitted light, the leaves of curly-top beets often persent a mottled appearance, but this is not usually to be observed by reflected light. Small but distinct elevations, of which no mention is made in the papers cited, are produced on the under surface of the curly-top leaves. (Pls. III, fig. 1, and IV, fig. 1.) Furthermore, no reference is made in these papers to an abnormal appearance of the roots of the diseased beets. In fact, the statement is made regarding what seems for some reasons to be curly-top in Indiana that the healthy and diseased roots can not be distinguished by any external characters. This may be true of the beets that are not affected until late in the season, but the roots of curly-top beets when attacked before the middle of the growing season are decidedly hairy, as shown in Plate I. Curly-top may be a bacterial disease, but certainly it does not seem to be due to an organism so easily seen and so readily separated as that in the disease described by Arthur and Golden.

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[a] Arthur, J. C., and Golden, Katherine E. Diseases of the Sugar-Beet Root. Bulletin No. 39. part 3, Purdue University Agricultural Experiment Station, p. 54.

Dr. Erwin F. Smith,[a] in charge of the Laboratory of Plant Pathology, Bureau of Plant Industry, in reviewing the work of Arthur and Golden expressed doubt in regard to bacteria being the cause of the disease of the sugar-beet root described by them and held that the trouble was curly-top. This led to a further study of this disease by Miss Cunningham.[b] It was not clearly established by her investigations, however, that the disease found in Indiana is due primarily to bacteria. In summing up the results Miss Cunningham says,[c] "Transfers of diseased tissue to the healthy beet root resulted in changed appearance of the plant which indicated almost certainly that the disease was transmitted." This still leaves the bacterial origin of the disease in doubt. Several citations to articles relating to bacterial diseases of the sugar beet were made by Miss Cunningham in connection with the article mentioned.[d]

These diseases were referred to by Sorauer[e] as "bacterial gummosis," by Kramer[f] as "bacteriosis," and by Busse[g] as "gummosis" of the sugar beet, but judged by the descriptions given, these diseases do not seem to be curly-top.

Subsequent to the work done by Arthur, Golden, and Cunningham in this connection, Doctor Smith made numerous tube cultures and poured plates from the interior of diseased beets received from the Agricultural Experiment Station of Indiana, but with no definite results. Frequently the cultures were sterile; at other times a variety of organisms was obtained in small numbers, especially if the beets were somewhat wilted. It is evident, therefore, that with our present knowledge of the curly-top disease we should not designate it as a bacterial disease of the sugar beet.

The remaining names of the disease in general use refer to certain characters of the affected plants, and it is largely a matter of judgment which one is most suitable. The names most commonly in use are "blight" and "western blight." Either of these names might be used without confusion were it not for the fact that we have in the middle and eastern parts of our sugar-beet area a true blight of the sugar beet due to the fungus *Cercospora beticola* Sacc. These might easily be distinguished as eastern and western blight of the sugar beet were it not for the circumstance that both may, and often do, occur in the same field in the middle part of the sugar-beet belt.

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[a] Smith, Erwin F. The Bacterial Diseases of Plants, a Critical Review of the Present State of Our Knowledge. American Naturalist, vol. 30, p. 116, 1896.

[b] Cunningham, Clara A. A Bacterial Disease of the Sugar Beet. Botanical Gazette, vol. 28, 1899.

[c] Cunningham, Clara A., l. c., p. 188.

[d] Cunningham, Clara A., l. c., p. 191.

[e] Sorauer, Paul. Note at end of a review of some papers on a disease of sugar cane. Zeitschr. f. Pflanzenkrankheiten, vol. 1, part 6, p. 360, 1891.

[f] Kramer, Ernst. Die Bacteriosis der Runkelrube (Beta vulgaris L.), eine neue Krankheit derselben. Oesterreichisches Landwirthschaftliches Centralblatt, vol. 1, part 2, pp. 30–36, and part 3, pp. 40–41, 1891.

[g] Busse, Walter. Bakteriologische Studien uber die "Gummosis" der Zuckerrüben. Zeitschr. f. Pflanzenkrankheiten, vol. 7, pp. 65–77 and 149–155, 1897.

The objection to the term "stunted beets" lies in the fact that this abnormality may be produced without developing the other symptoms of curly-top; that is, a stunting of the beet may be brought about by causes which do not produce the other symptoms of curly-top, as shown in Plate X, figure 2. "Whiskered beets" and "hairy-root" both refer to the peculiarity of the beet shown in Plate I, in which the small rootlets are very greatly multiplied. While this character is always noticeable on curly-top beets, it sometimes occurs on beets that do not possess the other symptoms of curly-top, and it is therefore undoubtedly produced by some condition that does not cause the development of all the symptoms of curly-top. Furthermore, this peculiarity of curly-top beets is only to be observed when the beets are pulled up. On the other hand, the peculiar appearance of the leaves of beets affected with this disease is noticeable as one passes through a field of beets in which curly-top occurs. The writer has therefore proposed the name curly-top for lack of a better and more characteristic one, which it is hoped will be supplied when the real cause of the disease is known. This character of the diseased plant is easily recognized and, as already pointed out, usually appears during the early life of the plant, but may become apparent in the latter part of the first season's growth or even during the second season.

POSSIBLE CAUSES OF CURLY-TOP.

In different localities and under different soil and climatic conditions curly-top appears sometimes without any apparent cause and sometimes accompanied by parasites or abnormal conditions of soil and climate. Various theories have therefore been advanced in order to account for the occurrence of this disease in the various localities where it has appeared. Among the theories that seemed most plausible because of the conditions and circumstances attending the occurrence of the disease, and which have on that account received more or less consideration, are the following:

(1) Bacteria.
(2) Fungi attacking the leaves.
(3) Fungi infesting the roots.
(4) Insects.
(5) Abnormal moisture supply.
(6) Abnormal soil conditions other than moisture supply.

(7) Abnormal atmospheric conditions.
(8) Poor seed.
(9) A combination of unfavorable conditions.

The following is a brief description of the methods employed and the results obtained in studying these possible causes of curly-top.

BACTERIA.

The symptoms of curly-top as already described suggest at first the presence of some parasite as the cause of the disease. The writer has made many attempts to prove or disprove the bacterial theory of curly-top. Nutrient agar plates have been poured from different parts of diseased beets of different ages and under different conditions of growth. In only a few cases has an organism been isolated, and such organisms have not induced the symptoms of curly-top with certainty in any case, as already stated on page 11. Inoculations have been made into various parts of healthy beets of different ages and under field as well as greenhouse conditions.

It might be argued that the organism was not capable of growth on the culture media used, and therefore could not be separated in the usual way. With this possibility in mind, pieces of tissue were cut from different parts of distinctly diseased beets and inserted into incisions made in healthy beets of different ages and under different conditions of growth, but always with negative results under the conditions employed.

FUNGI.

FUNGI ATTACKING THE LEAVES.

The general appearance of curly-top beets indicates a more or less starved condition of the plant, although a chemical examination of the diseased plant does not show an absence of the necessary food material. It is possible, however, that the cells of the diseased plant are incapable of utilizing the material that it has taken up. This led to the theory that the leaves might for some reason fail to perform their proper function and thus the whole plant become starved.

One of the most serious natural injuries that has been observed as occurring on beet leaves is that produced by the fungus *Cercospora beticola* Sacc. Pure cultures of this fungus were obtained and the spores were sprayed upon healthy leaves until they became as thoroughly infested with the fungus as possible. No symptoms of curly-top appeared in any of the beets thus treated, either immediately after treatment or during any subsequent growth of the plant. Likewise in the fields where Cercospora was most prevalent, no cases of curly-top have been observed, even when the plants were almost entirely defoliated by the fungus.

In order to carry the theory of leaf injury to the farthest limit, several hundred sugar beets growing in the greenhouse had their leaves removed and were left otherwise undisturbed. (Pl. VII, fig. 1.) New tops were rapidly formed, all of which were in every respect perfectly normal. (Pl. VII, fig. 2.) The treatment was repeated in the field in the West, where curly-top has frequently been found. Some of the rows of beets selected for this purpose were entirely defoliated several times by means of a sharp knife with no apparent result except a marked retardation in the growth of the beets. Finally, in those localities where curly-top is most prevalent, the beet leaves suffer least from attacks of fungi and the atmospheric conditions are most favorable for the performance of the life functions of the leaf. If curly-top is due to any changed condition of the leaf, that condition is not induced by a reduction of the leaf surface or by the inability of the leaf cells to perform their normal functions.

FUNGI ATTACKING THE ROOTS.

In certain parts of the sugar beet area where curly-top is found more or less frequently, the soil is sometimes permeated with a fungus that grows close to the main root of the beet, often matting the fibrous or feeding roots together. This fungus often forms in the soil a network of white filaments easily seen with the unaided eye. Pure cultures of the fungus, which proved to be a species of Fusarium, were obtained in the laboratory. The same fungus was found in fields containing diseased roots in widely separated areas, even from different States. Inoculations were made with this fungus, beets of different ages from seedlings with only two leaves to plants two-thirds grown being used. These inoculations were made both in the greenhouse and in the field. In some instances the fungus was simply placed in contact with the healthy root, and with other plants incisions were made in the roots and the fungus placed in contact with the cut surfaces; but in none of the artificial inoculations did the fungus seem to penetrate the tissues of the beets, and no symptoms of curly-top were produced in any of the plants inoculated.

A quantity of soil was obtained from one of the fields where curly-top prevailed in 1905, and this has been used for two years in growing sugar beets in the Department greenhouses at Washington under a great variety of moisture and temperature conditions. In some instances the moisture has been applied to the surface of the soil only; in other cases the seed and resulting plants have been watered only from below. Some of the plants have been given an abundance of moisture, while others have received just sufficient to keep the soil barely moist enough to keep the plants active. The temperature has varied from 85° F. to 50° F., some of the plants remaining constantly at a high temperature, others at a low temperature, and still others at an intermediate temperature. It is noticed that if the soil is allowed to become somewhat dry the fungus appears among the soil particles and around the roots of the plants, but in all of these experiments the only result noticed was a difference in the size of the plants. In no case were curly-top symptoms induced in any of the plants grown in this soil under the conditions used.

It should be added that the same fungus is often apparent in the soil, and even in contact with the beets, in fields where not a single case of curly-top can be found. Nevertheless, there may be conditions under which this or some other fungus in the soil may affect the beets directly or indirectly in such manner as to produce curly-top. In support of this theory is the fact that the writer has in a few instances found the mycelium of a Fusarium fungus actually growing into the tissue of the small roots of diseased beets. It can not be stated positively, however, that the disease is caused by a fungus until the disease can be produced at will by inoculations made from a pure culture of that fungus.

THE USE OF FUNGICIDES.

The fact that a fungus is found so frequently in connection with curly-top and that in a few instances a fungous mycelium has been found in the tissues of diseased beets has led to certain experiments with fungicides. The substances used were corrosive sublimate and copper sulphate. Solutions of different strengths were made and the roots of distinctly diseased beets were soaked in these solutions for different lengths of time.

The copper sulphate solution first used consisted of 1 part of copper sulphate in 3,000 parts of water by weight. One lot of beets was soaked in this for two minutes and another lot was soaked for five minutes. When removed from these solutions, the roots were all rinsed in distilled water. Upon examining these roots the following day, it was found that the fungus was not dead. The two lots of roots were again soaked for two minutes and five minutes, respectively, in the copper sulphate solution, 1 part of copper sulphate in 1,000 parts of water being used. This seemed to kill the fungus, and the beets were planted in 6-inch pots in the greenhouse.

The mercuric chlorid solution consisted of 1 part of mercuric chlorid in 1,000 parts of water by weight. One lot of beet roots was soaked in this solution two minutes and another lot was soaked five minutes, and both lots were then planted in 6-inch pots in the greenhouse. For comparison, a fifth lot of diseased beets was planted in 6-inch pots in the greenhouse without any treatment. A number of beets in each lot, including the controls, began after several weeks to present leaves with broader and smoother leaf blades, and in from three to four months the leaves were normal in shape. Some beets in each lot, including all treated lots, retained the curly-top symptoms, although the fungus could not be found again upon the treated beets.

It has been observed repeatedly that beets with distinct curly-top symptoms frequently recover to all appearances when kept for several weeks under normal greenhouse conditions, while others under similar conditions retain the symptoms of curly-top for months. In the vicinity of Washington, D. C., the treatment with fungicides would indicate that the destruction of the fungus growing in contact with the beet does not influence the recovery of diseased plants.

It is not to be assumed that the foregoing treatments with fungicides are considered practical, even if they caused the diseased plants to recover. The experiments were undertaken wholly for the purpose of shedding light upon the possible relation of a fungus to the disease under investigation.

INSECTS.

Frequently curly-top is associated with some insect pest. This occurrence often leads the grower to the conclusion that the insect most prevalent upon the diseased beets is the cause of the disease. While one of the many insect pests that infest growing beets may be responsible for the disease, in the opinion of the writer this has not yet been demonstrated beyond doubt, although Doctor Ball, Director of the Utah Agricultural Experiment Station, who has done considerable work on this subject in cooperation with the Bureau of Entomology, holds that the so-called "white fly" is the cause of curly-top.[a]

Frequently the curling of the leaves of curly-top beets seems to be due to a failure of certain portions of the leaf tissues to develop beyond a certain stage, as shown in the younger leaves in Plate III, figures 1 and 2, while certain other leaf cells seem to make an abnormal growth, causing the development of projections on the lower leaf surface, as shown in sections of leaves in Plate IV, figure 1. Whether or not these and other abnormal characters of curly-top beets are due in any way to the work of insects can only be determined by further investigations.

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[a] Ball, E. D. The Genus Eutettix. Proceedings of the Davenport Academy of Sciences, vol. 12, pp. 41 and 84 and plate 4, July, 1907. The Beet Leaf-Hopper, 16th Annual Report, Utah Agricultural Experiment Station, June, 1905, p. 16.

ABNORMAL MOISTURE SUPPLY.

ENTIRE SEED BED TOO DRY.

If one studies the curly-top disease in a restricted locality for a single season he will almost certainly be misled in his conclusions. With reference to no conditions attending the appearance of curly-top is this more generally true than with the moisture condition of the soil. In some localities where curly-top has been especially prevalent during certain seasons the seed bed has been particularly dry, so that the seeds germinated slowly and unevenly and the seedlings started with difficulty. As all other conditions so far as observed seemed favorable, it was fair to conclude that this one unfavorable condition was responsible for the diseased condition of the beets. However, if one continues his observations in another locality or into another season he will find cases of curly-top in fields where the moisture conditions were entirely favorable for germination.

In order to investigate this point still further, greenhouse experiments were conducted in which the minimum amount of moisture was used to germinate the seed, with the result that the seed was slower in germinating, but the seedlings, if given a sufficient supply of water, grew normally. If only a minimum amount of water was given the seedlings, they remained abnormally small, but otherwise showed no symptoms of curly-top. (Pl. X, fig. 2.)

INSUFFICIENT SUPPLY OF MOISTURE AT TAPROOT.

During the first few years in which curly-top was most destructive it occurred only in those localities in which there was a scarcity of moisture, and the diseased beets had the appearance of plants suffering from a lack of moisture. This led several observers, including the writer,[a] to arrive at the conclusion that curly-top is due to a lack of moisture at the taproot of the beet. Subsequent observations in the field and carefully conducted experiments in the greenhouse have demonstrated that whatever may be the cause of curly-top it is not lack of moisture alone.

In order to demonstrate more conclusively the effect of an insufficient water supply, a number of seedling beets were started in the greenhouse in large pots of earth. Some of these plants were given a sufficient quantity of water so that they were constantly supplied with moisture, some being watered entirely from below so that the taproot was constantly supplied, while others had the water applied only to the surface of the soil. Still a third set of plants started at the same time and under identical conditions received only enough moisture to keep them alive, and this was applied to the surface of the soil, the object being not to give sufficient water at a time to permit it to soak down and moisten the soil around the taproot. The results are shown in Plate X, figure 2, in which the dwarf plant (C) received only enough water to keep it alive. The leaves were normal except in size and the roots showed none of the curly-top symptoms.

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[a] Townsend, C. O. Some Diseases of the Sugar Beet. Report No. 72, United States Department of Agriculture. Progress of the Beet Sugar Industry in the United States, 1901, p. 90.

ENTIRE SEED BED TOO WET.

The observations of recent years seem to prove that too much moisture during the early part of the season might possibly be responsible for the appearance of curly-top. However, a series of observations in different localities shows that a wet seed bed may do considerable damage to the stand by causing the seed to rot and the seedlings to damp-off, but this is not necessarily accompanied by curly-top.

Greenhouse experiments along the same lines have demonstrated that an excess of moisture during the early life of the plant will not produce the disease. Likewise, a very wet seed bed not followed by the addition of moisture either in the form of rain or artificially applied does not, according to the observations made by the writer, insure freedom from curly-top in all cases. The distribution of diseased plants in the field, scattered as they frequently are here and there among the healthy beets, would prove that a seed bed too wet could not alone be responsible for the occurrence of diseased plants. Dr. Wilhelmj[a] is of the opinion that curly-top is closely connected with water supply, but this point does not seem to have been established by actual experiment and, as has already been indicated, one may reach almost any conclusion by extending or limiting his observations.

MOISTURE SUPPLY TOO VARIABLE.

In some of the irrigated sections where a limited amount of water is divided among a large number of growers, it sometimes happens that too much time elapses between the irrigations, so that the beets suffer for a longer or shorter period from lack of moisture. When the water is obtained the beets are given as much moisture as the ground will hold with the hope of being able to keep them supplied until water can be obtained again from the ditch. Under these conditions curly-top has sometimes appeared.

In order to determine the relation of variable moisture conditions to this disease, beets have been made to pass through their extremes of moisture and drought, the wet and dry conditions being carried farther and for a longer period in the experiment than in actual practice. The results have been only dwarfed plants without any curly-top symptoms. These experiments, combined with many field observations of beet growing in which there was great variation in moisture supply, sometimes entirely unaccompanied by curly-top, lead to the conclusion that this condition alone is not sufficient to produce the disease.

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[a] Wilhelmj, A. Eine Eigenartige Rübenkrankheit. Zeitschrift des Vereins der Deutschen Zucker-Industrie, April, 1907.

WATER TOO COLD WHEN APPLIED TO PLANT.

Since irrigation streams are frequently supplied with large quantities of water produced from melted snow, especially in the early spring, and since the young plants are most frequently affected with curly-top, the theory has been advanced that the early irrigation waters are too cold. It is difficult to understand how cold water could induce curly-top in a few beets here and there throughout a field, and yet it is not impossible when we consider the individuality of the beet. It is likewise difficult to explain under this theory the late cases of disease that appear in the middle and latter part of the summer.

However, in order to dispel all doubt in regard to the matter several series of beets were started in the greenhouse, and as soon as the seedlings appeared they were watered with ice water only. In some of the experiments the plants were watered with ice water every day or every two days, while in other experiments the interval between waterings was longer. These experiments were continued for several weeks without producing any curly-top symptoms.

It might be added as further evidence against this theory that one field which has been under the writer's observation for the seasons of 1905 and 1906 is irrigated with water from warm springs, yet each season a few cases of curly-top have appeared. Hence, cold water applied at any time during the growth of the plants is not the primary cause of curly-top.

ABNORMAL SOIL CONDITIONS.

SEED BED TOO COLD.

It is well known that a damp, cold seed bed has a marked influence upon the germination and growth of plants. There is a strong desire on the part of seed growers to plant their seed as early as possible, so as to give the plants a long season to grow and also to be able to harvest the beets before cold weather sets in. This practice sometimes leads the growers to plant before the ground is warmed to a normal planting temperature. While this condition has not always preceded an outbreak of curly-top, it has sometimes been associated with it, so it was decided to test the effect of a cold seed bed upon the growth of beets. Accordingly, an air cooler was installed in a small room in which the temperature could be controlled within certain limits. Boxes of soil were placed at different distances from the cold-air generator and also at different distances from the floor, and the soil was maintained at such temperature that germination and growth proceeded with difficulty. An insufficient supply of light in the room used for the work prevented the experiment from being entirely satisfactory, but during the several weeks that the plants lived they showed no signs of producing curly-top symptoms.

SEED BED TOO WARM.

The fact that the later plantings are the ones that are occasionally most severely attacked by curly-top raised the question with some growers as to the possibility of a too warm seed bed being the cause of the disease. In considering all the conditions under which curly-top is produced, especially the frequency of the disease in seed beds that are not above normal temperature, one must conclude that excessive warmth of the seed bed does not produce curly-top.

To test artificially the effect of an abnormal temperature, some seedling beets growing in pots of earth were placed near the furnace, where the temperature which was recorded daily from a maximum and minimum thermometer varied between 72° and 104° F. While the plants made very little growth, owing to the excessive heat, they showed no signs of curly-top even after several weeks.

SUBSOIL TOO HARD.

In some localities where curly-top has appeared, a hard subsoil has been found to exist so close to the surface of the ground that the beet roots grow down and come into contact with it without being able to penetrate it. This condition does not obtain in all places where curly-top has been found. Indeed, the disease frequently occurs in localities where the soil is of a rich loamy nature to the depth of several feet. Furthermore, in many localities where there is a hardpan underlying a shallow soil, beets grow without developing curly-top. The beets produced under these conditions may be dwarfed, they may extend abnormally out of the ground, or they may have sprangled roots, but these abnormalities do not necessarily accompany curly-top.

LACK OF AVAILABLE PLANT FOOD IN THE SOIL.

The apparent inability of curly-top beets to grow even where temperature and moisture conditions are known to be normal led some of the growers to assume that curly-top is due to a lack of available plant food in the soil. The inability of the badly diseased beets to grow would indicate either that the diseased plants were unable to take in the necessary plant food from the soil, from the atmosphere, or from both of these sources, or that having absorbed the necessary food material the plants were unable because of their diseased condition to assimilate it.

Experience has shown that plants growing in poor soil are no more susceptible to curly-top than those grown in rich soil. Further proof of the incorrectness of this theory is found in the fact that fields in which beets are utterly destroyed one season will without the application of any plant food produce a good yield and quality of perfectly healthy beets the following season. This has been demonstrated in actual practice under the writer's observation every season during the past six years. In one locality several thousand acres of beets were entirely destroyed by curly-top in 1903. The following season a large part of this area was replanted, and in every instance a most satisfactory crop of beets was obtained, the most diligent search failing to reveal a single case of curly-top. Many of these fields received no special treatment for the crop of 1904, and if there had been a lack of plant food during the season when the disease was prevalent it is fair to assume that there would have been the same lack of available plant food the following season. Again, a lack of available plant food would not affect 50 per cent of the beets in a field and leave the remaining ones perfectly healthy, especially with the two kinds scattered about over the entire area and standing, as they frequently do, within 8 or 10 inches of each other.

Plate X, figure 1, shows the fourteenth consecutive crop of beets on the same field without a single case of curly-top. Furthermore, sugar beets are frequently grown on soils that have become apparently exhausted by numerous grain crops; but it is very seldom that any cases of curly-top are found in these fields. Curly-top may be due to a starved condition of the beets, but if so the trouble is with the beet and not with the soil in which it grows.

LACK OF HUMUS IN THE SOIL.

The two main sources of humus for the irrigated lands of the West are stable manure and alfalfa. The small amount of stable manure produced as compared with the large area to be supplied with humus makes it impossible to obtain enough humus from this source to put the soil in the proper physical condition. Formerly it was customary with many farmers to let the alfalfa fields remain undisturbed for a long series of years if they continued to furnish a paying quantity of alfalfa. Under such conditions many of the other cultivated field crops suffered for want of humus, and the same conditions prevail in some localities at present, though many farmers now use alfalfa as a rotation crop, plowing it under after only three or four years. However, the scarcity of humus, especially in earlier years, has sometimes been associated with curly-top, a circumstance which led to the advancement of the theory that the scarcity of humus was the cause of the disease.

Observations of more recent years have tended to discredit this theory. For example, in some of the extensive wheat-growing areas of the West it has sometimes been customary to grow wheat after wheat for a number of years, in some cases even until the yield was no longer profitable. During these years of wheat growing, frequently no humus was added to the soil except the small amount furnished by the stubble. If, now, beets are grown in this soil the first crop will be poor; that is, the beets will be small but no curly-top will necessarily appear. The second crop of beets will be better than the first, and the third crop will be better than the second, even without the addition of any humus, but in no case will there be any curly-top that can be attributed to the lack of humus. On the contrary, curly-top has been found in more recent years just as frequently in fields well supplied with humus as in those that are deficient in this material. Furthermore, the fact that beets will thrive without the addition of humus in fields where they were entirely destroyed the previous season by curly-top is proof that the lack of humus alone is not the cause of this disease.

TOO MUCH ALKALI IN THE SOIL.

Many growers of beets in the more alkaline regions have associated curly-top with the presence of alkali. It is well known that the amount of alkali in certain layers of the soil varies from season to season and from time to time during the same season. Without any means of determining the amount of alkali in the soil it was assumed that the alkali was especially abundant in those spots or localities where the disease appeared. More recent observations have shown that the soil may contain a sufficient quantity of alkali to kill the plants without producing curly-top, and even if the quantity of alkali present is not sufficient to destroy the life of the plant, but only to interfere with its normal functions, a dwarfed plant will result, but none of the curly-top symptoms is necessarily produced. On the other hand, curly-top has been frequently observed in localities where an abnormal amount of alkali is not present at any time during the season.

Several series of greenhouse experiments were conducted to supplement the field observations in regard to alkali in relation to curly-top. In these experiments sodium chlorid and sodium carbonate solutions were used. The solutions were made up in four strengths, namely, 1 part of the salt to 1,000 parts of water, 1 part of the salt to 500 parts of water, 1 part of the salt to 100 parts of water, and a saturated solution.

The plants treated varied from seedlings 2 weeks old to beets 10 weeks old. With the seedlings, 10 c. c. of the solution were applied at a time; with the older plants, from 20 to 50 c. c. of the solution were given each beet at each application. The dilute solutions were applied to the plants daily for thirty-two days. Some of the plants died, while others remained alive, but assumed a yellowish tint without showing any signs of curly-top. The seedlings that received the saturated solutions all began to wilt within thirty minutes after the solution was applied. Several of the plants died without showing any tendency to recover, while others began to revive in from five to seven days and continued alive for several weeks with the appearance of normal beets. In the case of the older plants, the dilute solutions made no appreciable difference in their appearance or growth, while the saturated solution caused the leaves to assume a slightly paler tint, but in no case did the characteristic symptoms of curly-top develop.

SOIL TOO ACID.

While the Bureau of Soils was making a survey of one of the important sugar-beet localities in California in 1901,[a] certain observations were made regarding the relation between the acidity of the soil and the blight, or curly-top. It was noted by Messrs. Lapham and Heileman, who had direct charge of the survey of the area mentioned, that many of the soils in the valley under observation were either neutral or slightly acid and that few of the soils showed even a slight effervescence with hydrochloric acid, indicating either a very small amount of carbonate of lime or none. They observed further that the soil was acid in those fields where the disease occurred in that locality and that the disease did not occur in this locality in any soil that was alkaline to litmus. These observations naturally led Messrs. Lapham and Heileman to the conclusion that the deficiency of lime as carbonate gives rise to a neutral or slightly acid condition of the soil, which is a very important, if not the most important, factor in the cause of beet blight, or curly-top. As indicated, however, under the preceding theory, an alkaline condition of the soil does not prevent attacks of curly-top. Field observations and experiments indicate that applications of lime, whether light or heavy, will not prevent curly-top. It is possible, however, that under some circumstances an acidity of the soil may be a factor in producing curly-top.

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[a] Lapham, M. H., and Heileman, W. H. Field Operations of the Bureau of Soils, Department of Agriculture. Soil Survey of the Lower Salinas Valley, California, 1901, p. 506.

IMPROPER PREPARATION OF THE SEED BED.

A properly prepared seed bed is one that is plowed at the right time, under proper conditions of moisture, and to the correct depth without turning up too much raw soil. It must be worked at such time and in such manner as to conserve the moisture and to produce a firm seed bed below, with a fine mulch about 1½ inches thick on the surface. Owing to the many conditions to be fulfilled in properly preparing a bed for beet seed, it is not surprising that in many of the fields in which curly-top has appeared one or more of these conditions have not been fulfilled. This was especially true several years ago, before beet growing was as well understood as it is at the present time.

This theory was suggested by the appearance of curly-top in certain fields, while in other fields in the same locality differently prepared to receive the seed, the disease was absent. More extended observations and experiments teach us that plants growing in the most thoroughly prepared seed bed are sometimes seriously affected with the disease. Again, the distribution of the diseased plants in the field, as previously mentioned, contradicts this theory.

IMPROPER CULTIVATION OF THE BEETS.

This may include both the time of cultivation and the method employed. It is generally conceded that cultivation should be begun as soon as the rows can be followed, but in regard to the depth of cultivation and the distance that the cultivator teeth should be kept from the plants there is considerable difference of opinion among beet growers. One of the strongest arguments against the belief that lack of cultivation may be a cause of the disease is to be found in the abandoned or neglected beet fields which one occasionally finds here and there in different parts of the sugar-beet belt, inasmuch as these abandoned fields are frequently free from curly-top. If the method of cultivation is a factor in producing the disease, it is presumably because of the injury to the side roots due to deep or close cultivation or to both deep and close cultivation. We find that deep and close cultivation are practiced just as frequently in the areas where curly-top has never appeared as they are in those areas where the disease has been most destructive.

By way of experiment a number of beets of different ages were injured by cutting the side roots with a large knife. The results so far as curly-top is concerned were negative.

The first operation in caring for the beets after they are up is that of thinning. It is well known that any delay in performing this operation will result in a decrease in the yield of beets to the acre, but so far as can be ascertained by field observations and greenhouse experiments the delay does not produce any of the symptoms of curly-top.

INSUFFICIENT SUPPLY OF AIR AROUND THE ROOTS.

It is well known that the roots of land plants must receive a sufficient quantity of air in order to produce a normal growth of the plant. The appearance of curly-top in many fields where a crust had formed on the surface of the soil led some observer to think that this disease might be due to a lack of air around the roots. A study of curly-top in other localities established the fact that the disease is not confined to those fields where a crust has formed on the surface, nor even to those localities where the soil is of such a nature that the crust forms readily under the conditions that prevail during the early life of the plants.

In some instances curly-top has appeared in localities where there was an excessive supply of moisture in the early part of the season. This led to the suggestion that too much moisture at the taproot, if continued for some time, might produce curly-top by cutting off the air supply. In some of the many sections of the sugar-beet area certain seasons have been excessively wet. Some fields not properly drained have been for a number of days under water. This abnormal condition, if of sufficient duration, invariably results in a weakened condition of the beets, as indicated by the yellow color of their leaves, a state from which they may eventually recover to a considerable extent if normal conditions are restored and allowed to continue. In no case where these excessive rainfalls have occurred and abnormally wet conditions have prevailed for several weeks have any symptoms of curly-top been observed.

Curly-top usually occurs in the irrigated sections, where the danger of excessive moisture is, of course, at a minimum. In the greenhouse this abnormally wet condition of the taproot has been repeated with plants of different ages and at different temperatures with similar negative results. As already pointed out, curly-top often appears in those fields where the soil is well drained and under thorough cultivation and thrives where the conditions for a proper air supply are best. While a lack of air around the roots may be a secondary factor in producing curly-top, it certainly is not the primary cause of this disease.

ABNORMAL ATMOSPHERIC CONDITIONS.

ATMOSPHERE TOO COLD AT TIME OF GERMINATION.

The experiment just described served also to illustrate the effect of a cold atmosphere upon the young beet plants. Aside from retarded growth, no abnormal symptoms were observed. Frequently in the field one finds that the desire to plant early leads to the production of seedling beets before the cold nights are over, so that the young plants are subjected to extremes of temperature. While these conditions have sometimes been followed by a more or less severe outbreak of curly-top, there have been so many exceptions that one is led to the conclusion that no relation exists between curly-top and the cold atmosphere.

HOT, DRY WINDS.

In many fields where curly-top appears, windbreaks are to be found along one side of the field. These windbreaks may consist simply of a fence, or of a row of trees, or of a field of grain. It has been frequently observed that the beets growing close to the windbreak, and therefore most completely protected from winds, are least affected by curly-top. (Pl. IX, fig. 1.) These observations lead to the theory that hot, dry winds blowing over the beet fields, as they often do nearly every day at certain hours in some localities, induce the disease.

In order to produce as nearly as possible the same conditions artificially, a number of seedling beets were started in pots in the greenhouse, and when firmly established were placed in the laboratory engine room, where the heated air from the boiler could be blown over the plants. This was accomplished by arranging an electric fan on the same level with the plants and allowing the fan to blow the hot air from the boiler over them for several hours each day. The plants were supplied with an abundance of moisture and all other conditions were normal, except that the light was not as intense as it would have been in the open. Several sets of plants were treated from two to four weeks in the manner described. Some of the plants died, presumably from the treatment, but in no case did any symptoms of curly-top appear, either during the treatment described or during the subsequent life of those plants that were returned to the greenhouse alive. Therefore, the experiments thus far conducted along this line indicate that hot winds alone are not the cause of curly-top. At the same time it is difficult to explain why it is that the healthier beets are frequently found in the more protected localities. One exception to this general rule was observed during the summer of 1906 on the Department experimental farm at Amarillo, Tex. About one acre of beets was grown for experimental purposes, and that part of the plot best protected from the prevailing winds by a plot of sorghum contained many specimens of curly-top.

POOR SEED.

More frequently than any other one factor in sugar-beet growing, the quality of the seed has been held responsible by the growers for the outbreaks of curly-top. Many of the men who hold to this theory have no definite idea in regard to what constitutes the particular poor quality of the seed that causes curly-top to develop. Some growers, however, believe that there is in some seeds an inherited tendency toward the disease, while others maintain that small or poorly developed seeds produce weak plants that are unable to grow in a normal manner and are therefore easily attacked by disease.

Whatever view is held in regard to the details of this theory, the distribution of the diseased plants in the field a badly diseased plant often standing within a few inches of a perfectly healthy one—would tend to support the poor-seed theory. On the other hand, we find a number of circumstances that appear to render this theory impossible. In 1903 curly-top destroyed 50 per cent of the beets in a certain locality, and the seed used was a part of a shipment the remainder of which was used, according to good authority, in two other localities. In the second and third localities where this seed was used practically no curly-top developed. It should be further noted that some fields in the badly diseased locality were entirely free from curly-top, although they were planted with seed from the same shipment. If all fields and all localities in which this seed was used had been equally affected we would have strong proof of the poor-seed theory.

In 1904 certain fields reported to have been planted from the same sack of seed were variously affected, some being very badly diseased and others practically not at all. If curly-top is due to the quality of the seed, it would be difficult to explain why some seed beets show curly-top symptoms during the second year's growth when they were to all appearances perfectly healthy during the first season of their existence.

In experiments with small seeds as compared with large ones, the plants in both cases have been equally free from curly-top. In these experiments it must be remembered that the size of the seed ball does not indicate the size of the individual seed. This latter point can be determined only by close examination of the seeds to be used.

Finally, the same quality of seed is generally used in different parts of the sugar-beet area. If curly-top is due to inferior seed it will be necessary to find some explanation for the entire absence of curly-top in certain portions of the sugar-beet area. Whatever the cause of curly-top may be, the bulk of the evidence indicates that the quality of the seed is not the primary factor in its development.

COMBINATION OF UNFAVORABLE CONDITIONS.

Negative results in matters like the foregoing are conclusive only so far as they relate to existing conditions and circumstances, and it must be remembered that under other conditions the same agent or factor might give positive results. Therefore, it can be stated with certainty only that the factors discussed are not responsible for curly-top under the circumstances and conditions under which the observations and experiments were made; that is, there may be conditions not yet investigated in which the fungus, for example, may produce the curly-top symptoms. Or it may be that some fungus other than the one isolated may yet be found to be responsible for the disease. In considering the possible factors that might cause curly-top, many combinations of unfavorable conditions have been suggested and many of them have been investigated. In this connection the theories mentioned may conveniently be considered under the following groups, namely: Parasites, soil conditions, weather conditions, cultural conditions, and seed.

The bacterial and fungus parasites isolated have been tested; that is, inoculations have been made into healthy beets of different ages, from seedlings a few days old to beets one-half to two-thirds grown. Both field and greenhouse conditions have been tried; the field conditions under various methods of irrigation, the greenhouse conditions under different degrees of temperature and moisture. Various combinations of soil conditions have been made, dry and moist soil being used at temperatures varying from 80° F. to 50° F. Dry and moist soils were combined with hot, dry winds, and consequently hot, dry winds were combined with dry and moist soils. The same seed was tried under different conditions of soil with respect to dryness and moisture, with respect to alkalinity and acidity, and with respect to temperature and time of planting. In none of the combinations of unfavorable conditions that have been tried have any indications of curly-top traceable to these conditions been produced. It is entirely possible that some combination of conditions will be found that will produce the curly-top symptoms. However, the matter does not seem as simple to the writer as it is expressed by Doctor Wilhelmj[a] when he says the beets do not become diseased whether they have a great deal of moisture or none at all in the form of rain during the first part of their growing period, but that they do become diseased if a hard rain falls after a period of drought. It is undoubtedly true that the digestion of curly-top beets has become abnormal, as Doctor Wilhelmj states,[a] but the cause of this disturbance has, in the writer's opinion, not yet been established.

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[a] Wilhelmj, A., l. c., p. 432.

NONCONSECUTIVE APPEARANCE OF CURLY-TOP.

One of the most important facts in regard to curly-top is that it very seldom appears two consecutive years in the same locality. During the six years that this disease has been under observation by the writer it has been destructive during two consecutive years in but one locality, and in this case the relative number of diseased beets was not nearly so great the second year as it was the first. In general, it may be said that the appearance of curly-top in a given locality one season does not in any way endanger the crop for the following year. As previously stated, the locality in which curly-top was so destructive in 1903 had an exceptionally good crop in 1904, practically no cases of curly-top being found even in the fields in which the beets were entirely destroyed the preceding year.

BEETS RESISTANT TO CURLY-TOP.

The distribution of healthy beets among diseased ones in many badly infested fields, as shown in Plate IX, figure 2, would seem to indicate that certain beets are resistant to curly-top. For the purpose of breeding plants resistant to this disease, several hundred healthy beets were selected and siloed. Care was taken to find healthy beets that were growing close to badly diseased ones, so that in case of possible communicability of the disease we would have those that were unmistakably resistant. Selections of this kind were made in different localities in 1902, 1903, and 1904. In each case the siloed beets came through the winter in good condition for planting, and very nearly all of them produced seed which was of good quality. The difficulty in determining whether or not the seed would produce beets resistant to curly-top was found in the fact that it is impossible to predict where the disease will occur in any given season. It has never been serious in more than three or four localities at one time, and these more or less restricted; and the fact already pointed out that it practically never occurs two years in succession in the same locality makes it impossible to know where to grow the beets to determine whether or not they are resistant to curly-top. Even if we knew in what locality the disease would occur, the fact that adjacent fields or different parts of the same field are affected to very different degrees so far as the appearance of the disease is concerned would still render the problem impossible of solution from this standpoint. Again, it would seem that plantings made in any locality just as soon as the disease makes its appearance ought to help in determining the resistance of plants; but observation has shown that plantings made with the same seed, but a few days before or after certain badly diseased fields were planted, are frequently but slightly if at all affected with curly-top.

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[a] Wilhelmj, A., l. c., p. 435.

At one of our sugar-beet stations where a quantity of seed selected for curly-top resistance was planted along with twenty-five other varieties and strains, some curly-top beets were found in each plot. This seed was all planted on April 22, 1907, and each plot received the same treatment throughout the season. At the end of the growing season a careful count of all the curly-top beets found among each of the twenty-six varieties and strains grown on equal areas showed that for every 10.7 beets affected with curly-top found among those grown from seed selected for curly-top resistance there were from 22 to 124 among the other twenty-five varieties and strains not selected for resistance. A large number of selections were made from the plot that indicated curly-top resistance, and this strain will be perpetuated and improved with a view to making it entirely resistant to curly-top.

COMMUNICABILITY OF CURLY-TOP.

All evidence thus far obtained is against the transmission of curly-top from plant to plant by any known means. In the field we find beets badly diseased growing side by side with others to all appearances perfectly healthy. It is not uncommon for this condition to exist throughout the season. Furthermore, several instances have been observed by the writer in which two plants have been found growing in close contact with each other, one showing all the symptoms of curly-top and the other presenting a perfectly normal appearance. This state of contact continued throughout the season without developing any curly-top symptoms in the healthy beet. Bits of tissue have been cut from diseased beets and inserted in incisions made in different parts of healthy beet roots, but in no case has curly-top developed under the conditions used. No definite conclusion can be reached regarding the point, however, until the exact cause of curly-top is known.

PERSISTENCE OF CURLY-TOP.

In almost all cases, beets that have become unmistakably affected with curly-top either die from the effects of the disease before the end of the season or, if the beets continue to live throughout the season, as they frequently do unless the outbreak is very severe, the curly-top symptoms remain apparent. No amount of special attention seems to be effective in restoring the diseased beets to a normal condition so long as they remain in the field where they were first attacked. In some instances if they are taken up and removed to some other soil they seem to recover after several weeks, so far as the appearance of the leaves is concerned. Thus, a badly diseased beet transplanted to a greenhouse of the Department of Agriculture in August, 1902, was photographed six months later, showing the flat leaves commonly found on healthy beets. (Pl. VI, fig. 2.) This change does not always take place, however, even when the beets have been placed under different climatic conditions and transplanted into entirely different soil.

Some badly diseased beets planted in the greenhouse in August, 1905, still retained their curly-top symptoms even at the end of eight months. If the diseased leaves are removed the new set produced shows all the leaf symptoms of curly-top. If the new set of leaves is in turn removed the third set may be as badly affected as the first or second, as demonstrated by repeated experiments in the greenhouse and in the field. If the beets are left in the field and given special attention in the way of irrigation, cultivation, etc., the curly-top continues to develop in the same way and to the same extent as in the adjacent rows where the beets have received no special attention.

SUMMARY.

Curly-top is not identical with any disease of the beet previously described, except possibly that described from Indiana.

It is a distinct disease with well-marked symptoms.

It has not been reported with certainty from any country other than the United States.

It has thus far been confined to the middle and western parts of this country.

It is capable of appearing under a great variety of soil and climatic conditions.

It does not seem to be produced by any one abnormal condition of soil or climate.

It does not seem to be due to any parasite isolated thus far.

It does not seem to be due to the condition of the seed.

It attacks stock and garden beets as well as sugar beets.

It is not limited to beets of any particular age.

It does not seem to be communicated directly from beet to beet.

It has not appeared to any serious extent two years in succession in the same locality.

There are indications that a strain of beets resistant to curly-top may be developed.

Growers need not hesitate to plant beets in a field even though their entire crop of beets in that field was destroyed by curly-top the preceding year.

PLATES.

DESCRIPTION OF PLATES.

Plate I. (*Frontispiece.*) A sugar beet four months old, showing the usual external symptoms of curly-top—the curled and twisted leaves with greatly shortened stems and poorly developed blades, but abnormal in number; also the excessive development of side roots on the dwarfed main root. (Natural size.)

Plate II. A healthy sugar beet four months old for comparison with the diseased beet shown in Plate I. (About one-fifth natural size.)

Plate III. Fig. 1.—Leaves from a sugar beet three months old affected with curly-top; one leaf from each whorl. The rough lower surfaces are apparent as well as the short petioles and undeveloped and twisted blades. (About three-fourths natural size.) Fig. 2.—Leaves from a healthy beet of the same age as that shown in figure 1; one leaf from each whorl. The young leaves are not yet fully expanded. (About one-fourth natural size.)

Plate IV. Fig. 1.—Cross section of a healthy leaf through a vein, showing the position of the tissues. Fig. 2.—Section of a leaf through a vein of a curly-top leaf, showing the abnormal position of the fibro-vascular bundle and the unnatural cell development producing among other changes the projections on the lower surface of the leaf.

Plate V. Fig. 1.—Cross sections of a sugar beet four months old affected with curly-top. The cuts were made at intervals of 1 inch, beginning 1 inch from the crown. The rings of fibro-vascular bundles show the dark color characteristic of curly-top. The rings are more striking in the larger part of the beet; each section, however, has the dark color. (About natural size.) Fig. 2.—Cross sections of a healthy sugar beet of same size as that shown in figure 1. Fibro-vascular bundles are apparent, but are not dark. The photographs for both figures were taken one hour after cutting. The sections for figure 2 were made at intervals of 1 inch, beginning 1 inch from the crown, as in figure 1. (About natural size.)

Plate VI. Fig. 1.—Longitudinal section of a sugar beet four months old affected with curly-top, showing how the dark fibro-vascular bundles are continuous throughout the length of the plant. (About four-fifths natural size.) Fig. 2.—A sugar beet that was obtained in August, 1903, at which time it had all the symptoms of curly-top shown in Plate I. This photograph was made seven months later, and the leaves have almost no curled appearance. The plant appears to have recovered from the curly-top. (About two-sevenths natural size.)

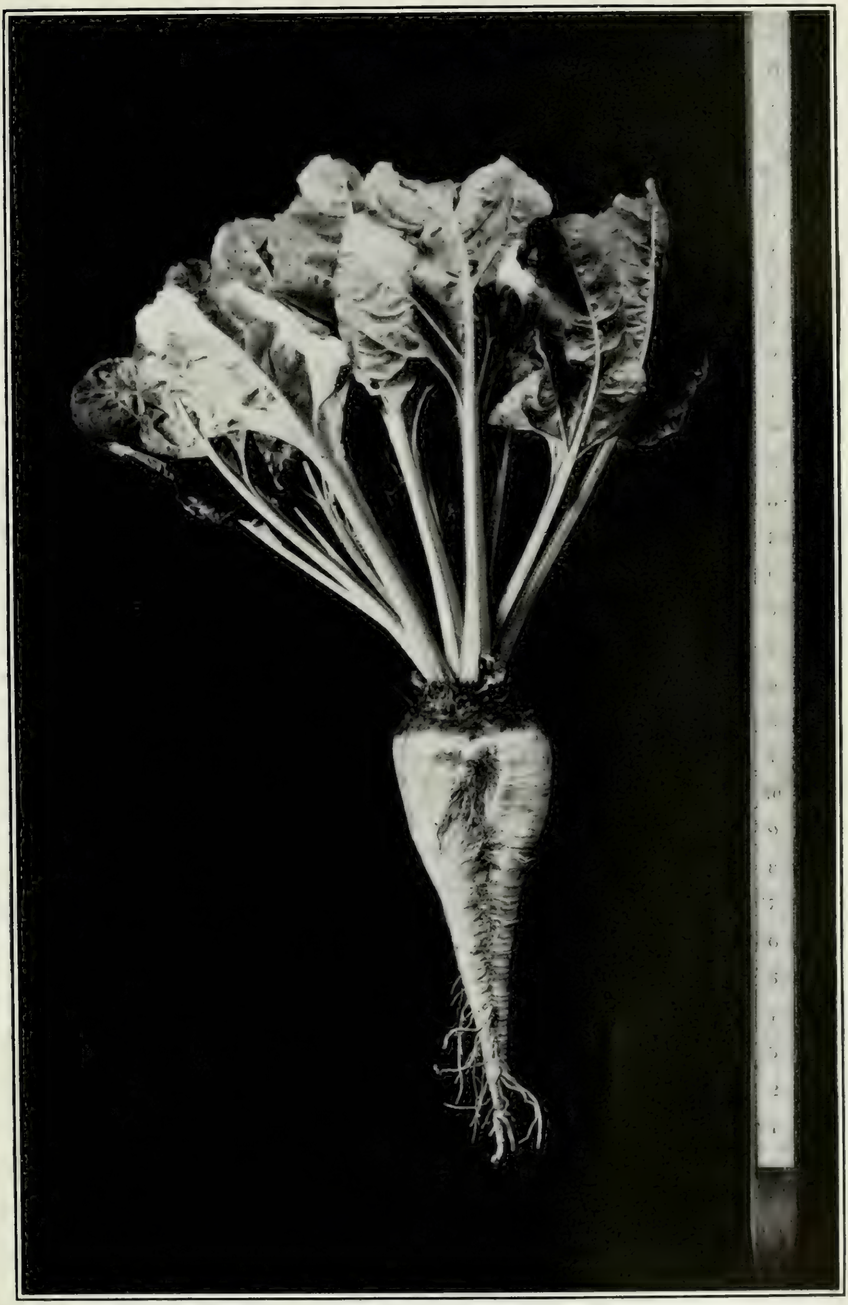
Plate VII. Fig. 1.—Beets six weeks old defoliated just above the crown by means of a sharp knife. Conditions for growth remain normal. Fig. 2.—The same plants four weeks later, showing new vigorous tops free from even the slightest symptom of curly-top.

Plate VIII. Fig. 1.—Garden beets four months old showing symptoms of curly-top. These beets were in a row on south side of seed beets among which were a number of cases of curly-top. Fig. 2.—Garden beets from same row showing no sign of curly-top.

Plate IX. Fig. 1.—Field that was planted to sugar beets and a good stand obtained. Curly-top has destroyed all the beets in the foreground. In the remainder of the field there are many cases of curly-top, but the beets continue to live. Fig. 2.—Field of beets affected with curly-top, showing the possibilities of selection for curly-top resistance. Not more than 1 per cent of these beets are free from curly-top.

Plate X. Fig. 1.—Field showing the fourteenth consecutive crop of beets free from curly-top, proving that successive planting of beets without crop rotation will not of itself produce the disease. Figure 2 represents three plants (*A*, *B*, *C*) which received treatment as follows: *A* received an abundant supply of water from below only, *B* received an abundant supply of water from the surface only, and *C* received just enough water to keep the plant alive, but never enough at any one time to soak down to the taproot. The plant *C*, although small, is in all respects perfectly healthy; that is, it possesses no symptoms of curly-top, which shows that an absence of moisture from the taproot is not a condition which in itself will produce curly-top. Plants *A*, *B*, and *C* are of exactly the same age. (About one-eighth natural size.)

Plate XI. Fig. 1.—Stem of seed beet affected with curly-top. This plant showed no indication of curly-top during its first season's growth. Fig. 2.—Stem of healthy seed beet for comparison with that shown in figure 1.



A HEALTHY SUGAR BEET FOUR MONTHS OLD.

(About one-fifth natural size.)

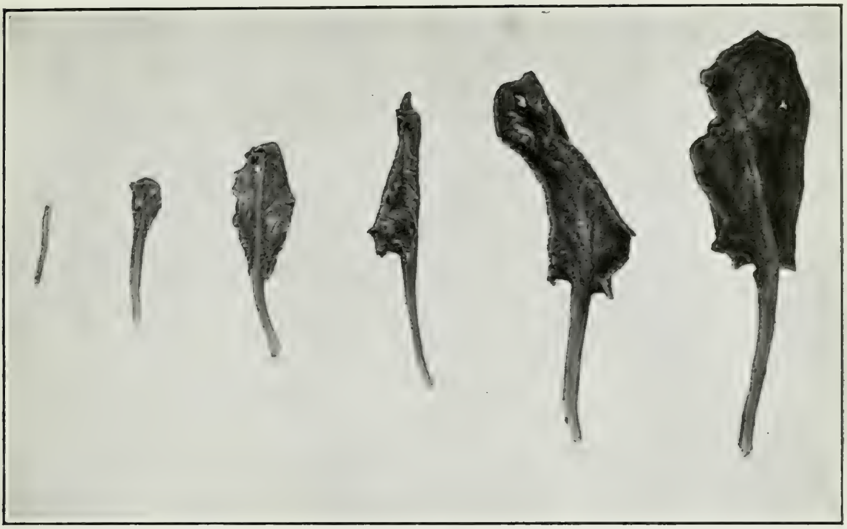


FIG. 1.—LEAVES FROM A SUGAR BEET THREE MONTHS OLD AFFECTED WITH CURLY-TOP.

(About three-fourths natural size.)

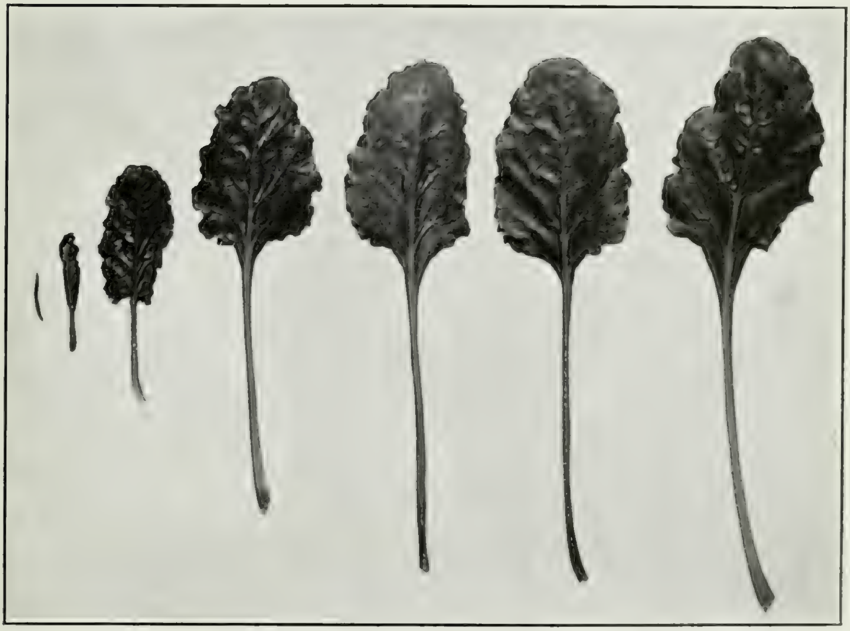


FIG. 2.—LEAVES FROM A HEALTHY SUGAR BEET THREE MONTHS OLD.

(About one-fourth natural size.)

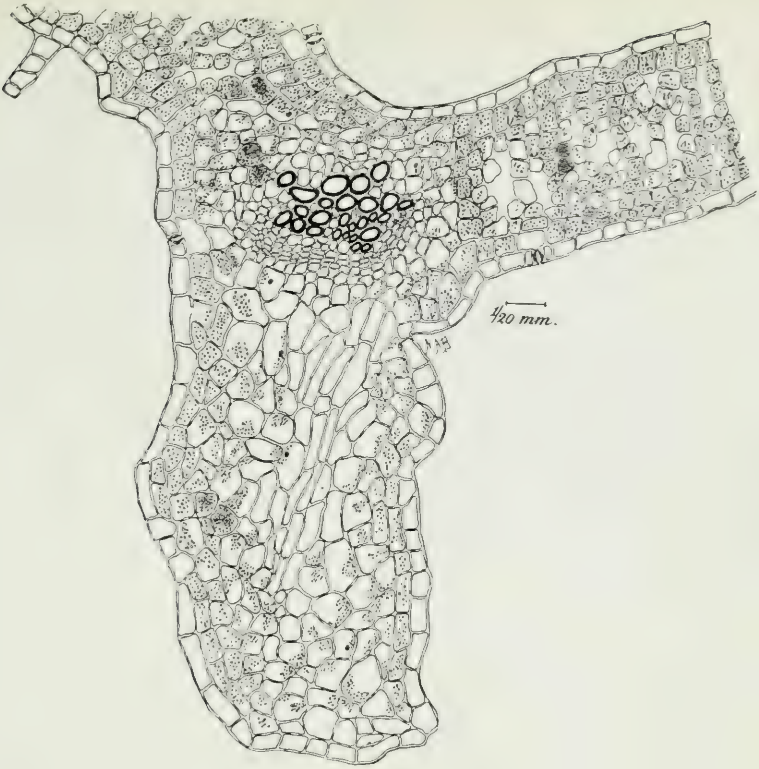


Fig. 1.—Cross Section Through a Vein of a Beet Leaf Affected with Curly-Top.

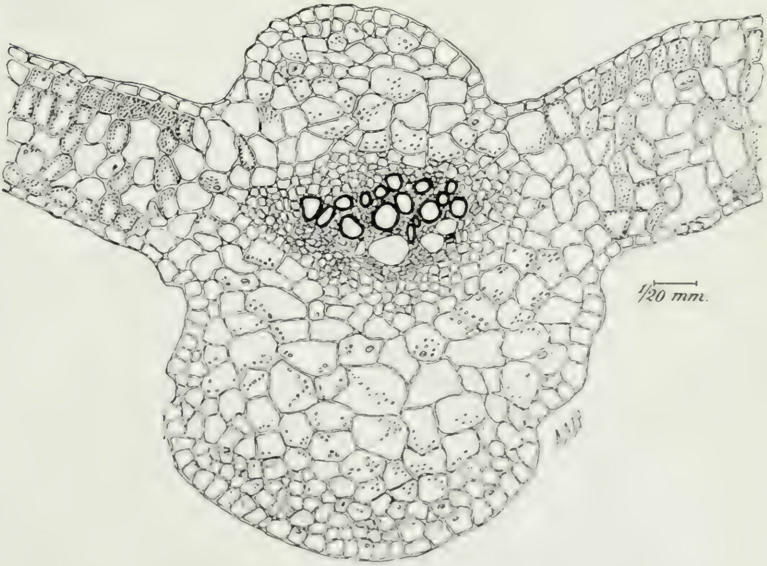


Fig. 2.—Cross Section Through a Vein of a Healthy Beet Leaf.

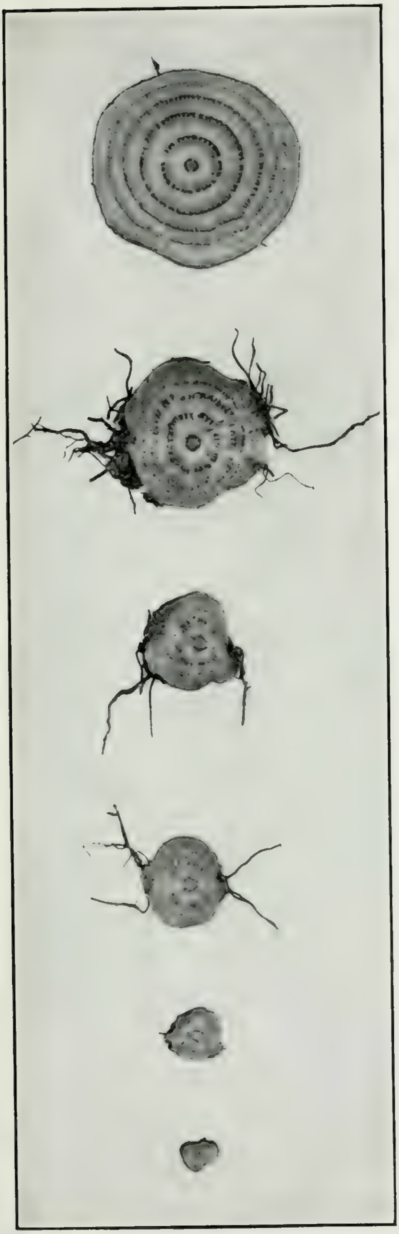


FIG. 1.—CROSS SECTIONS OF A SUGAR BEET FOUR MONTHS OLD AFFECTED WITH CURLY-TOP.

(About natural size.)

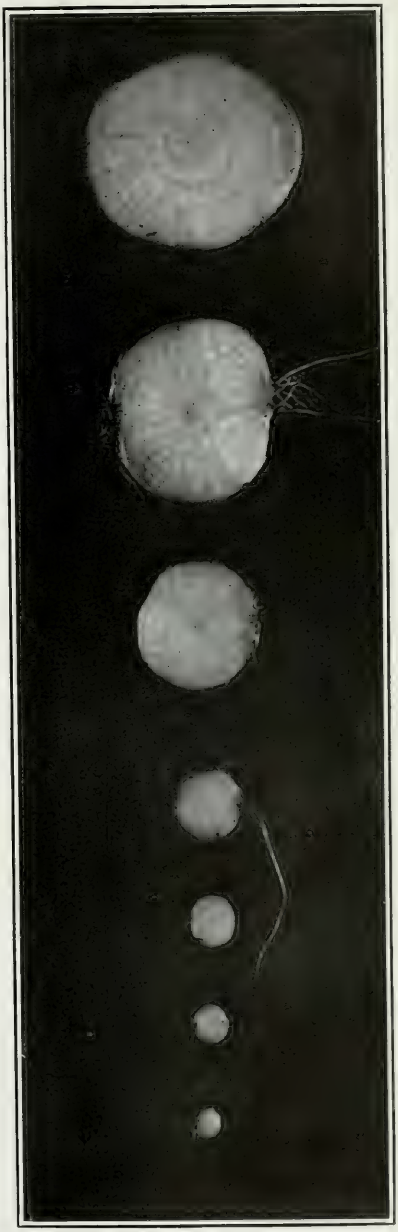


FIG. 2.—CROSS SECTIONS OF A HEALTHY SUGAR BEET THREE MONTHS OLD.

(About natural size.)

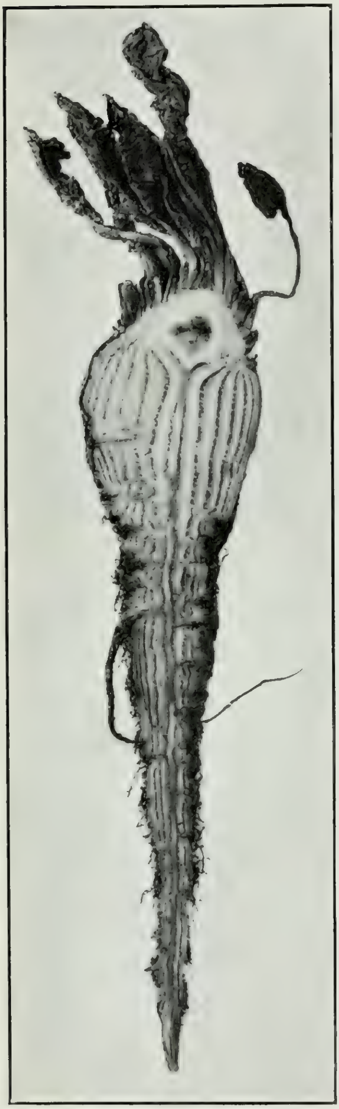


FIG. 1.—LONGITUDINAL SECTION OF A SUGAR BEET ABOUT FOUR MONTHS OLD AFFECTED WITH CURLY-TOP.

(About four-fifths natural size.)

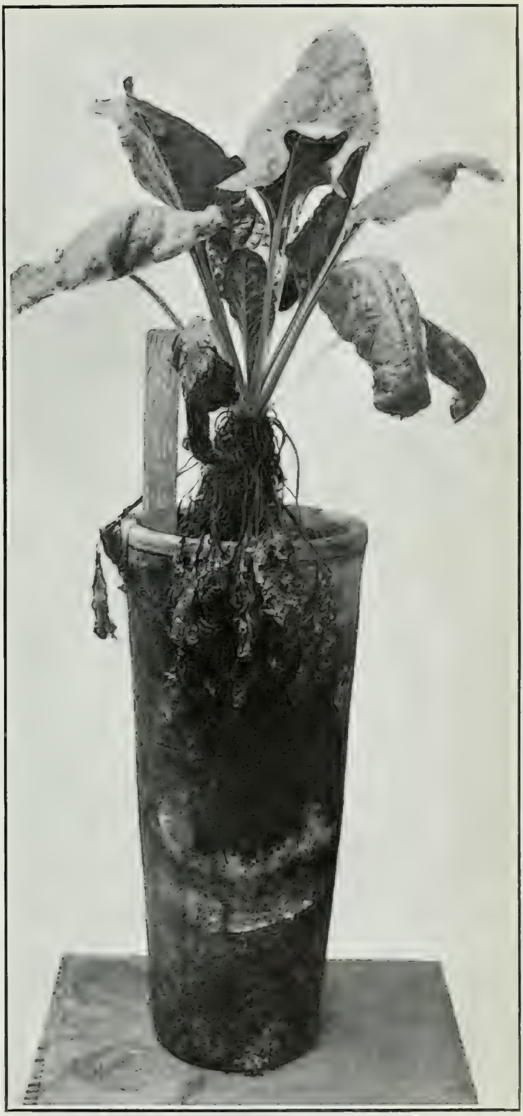


FIG. 2.—A SUGAR BEET PLANT THAT HAS APPARENTLY RECOVERED FROM AN ATTACK OF CURLY-TOP.

(About two-sevenths natural size.)

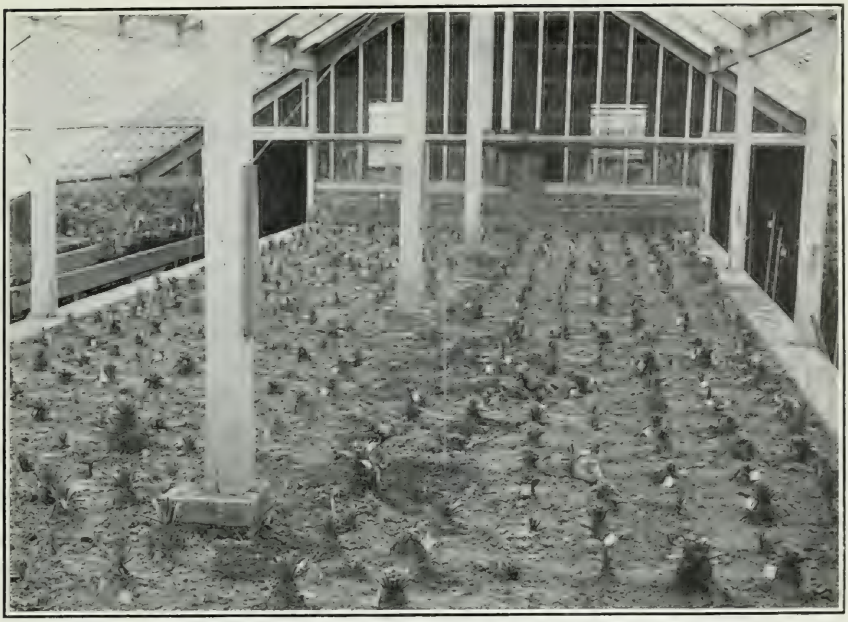


FIG. 1.—BEETS IN GREENHOUSE DEFOLIATED ARTIFICIALLY.

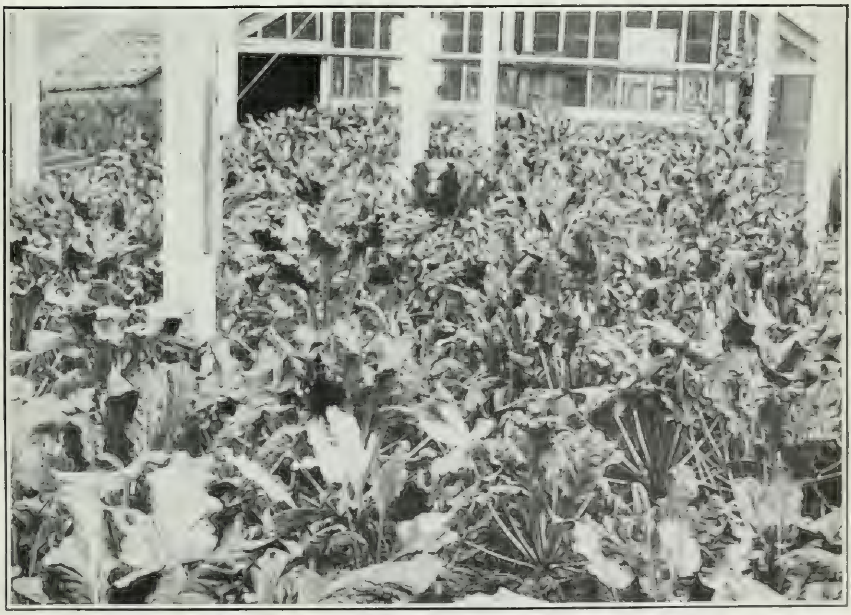


FIG. 2.—THE SAME BEETS SHOWN IN FIGURE 1 WITH NEW TOPS FOUR WEEKS AFTER DEFOLIATION.

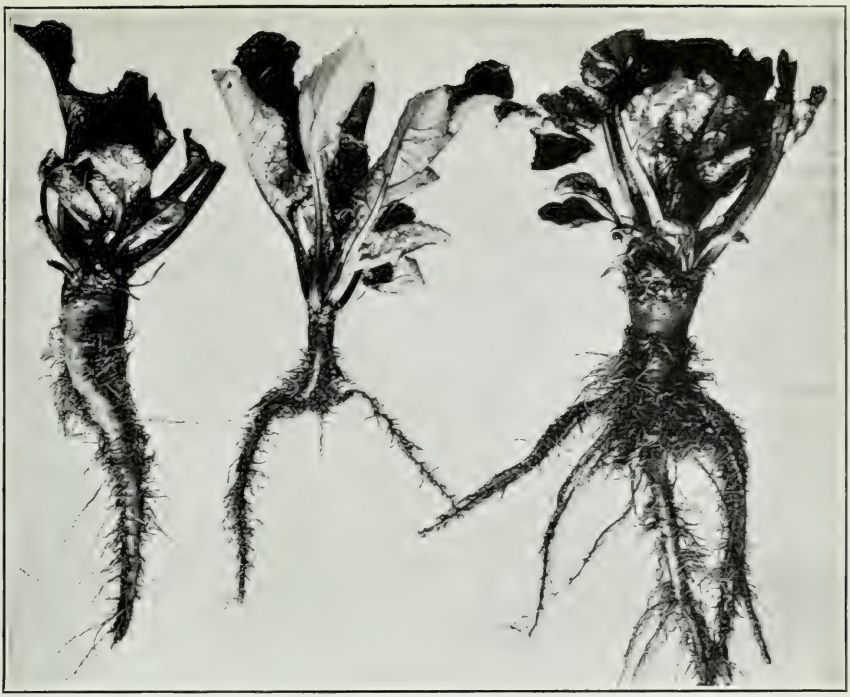


FIG. 1.—GARDEN BEETS FOUR MONTHS OLD SHOWING SYMPTOMS OF CURLY-TOP.

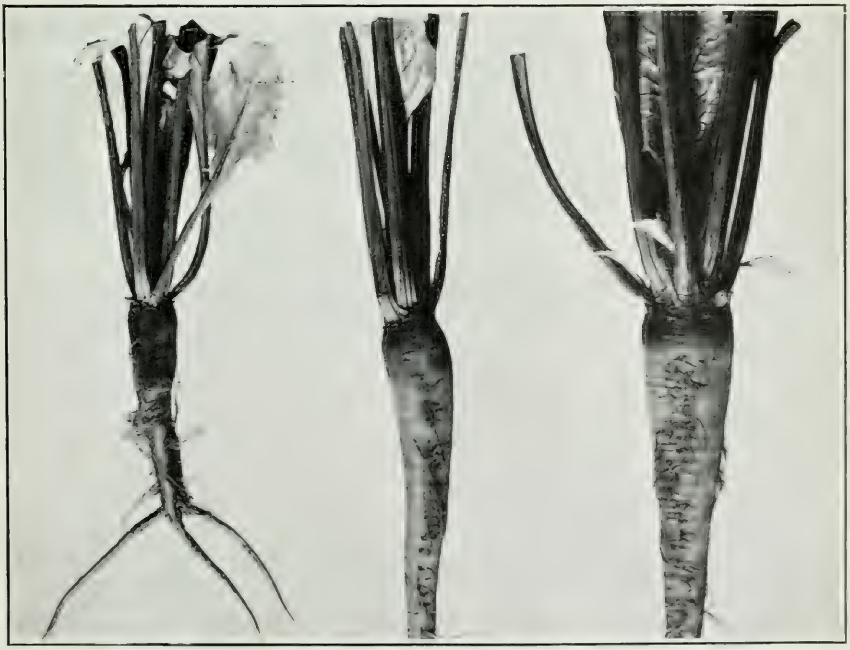


FIG. 2.—GARDEN BEETS FOUR MONTHS OLD FREE FROM CURLY-TOP.

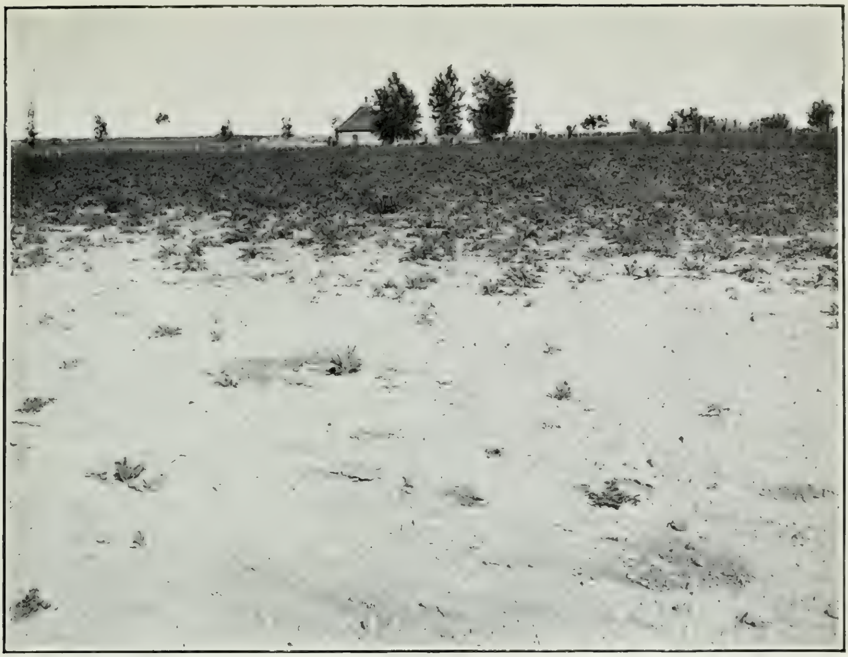


FIG. 1.—SUGAR BEET FIELD IN WHICH NEARLY ALL THE PLANTS IN THE FOREGROUND HAVE BEEN DESTROYED BY CURLY-TOP.

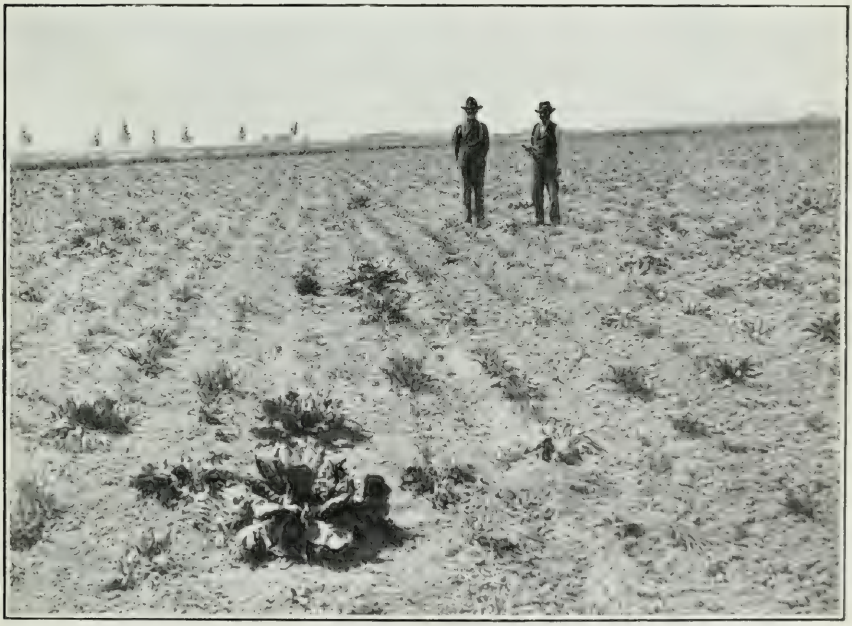


FIG. 2.—FIELD OF SUGAR BEETS SERIOUSLY AFFECTED WITH CURLY-TOP, SHOWING HERE AND THERE AN APPARENTLY HEALTHY BEET.

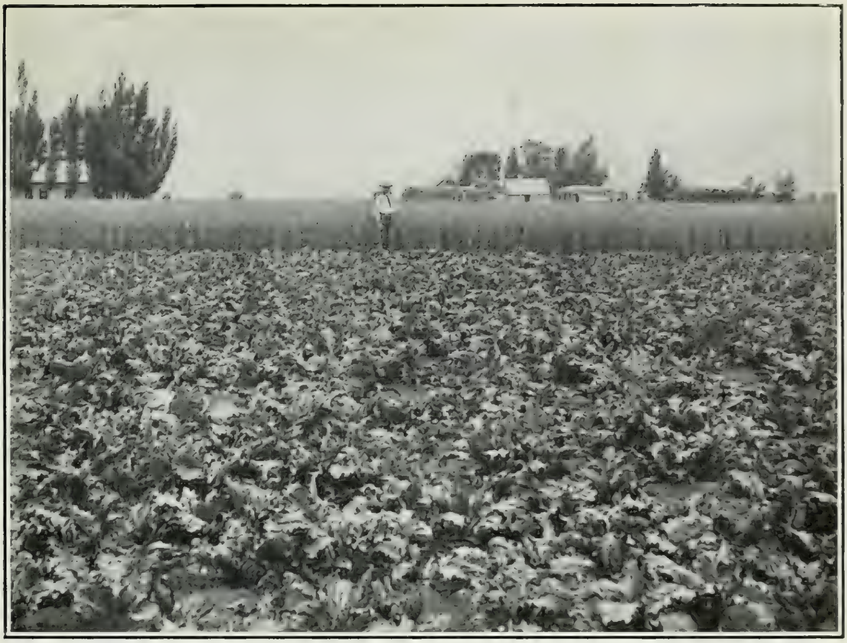


FIG. 1.—THE FOURTEENTH CONSECUTIVE CROP OF SUGAR BEETS IN A FIELD ENTIRELY FREE FROM CURLY-TOP.

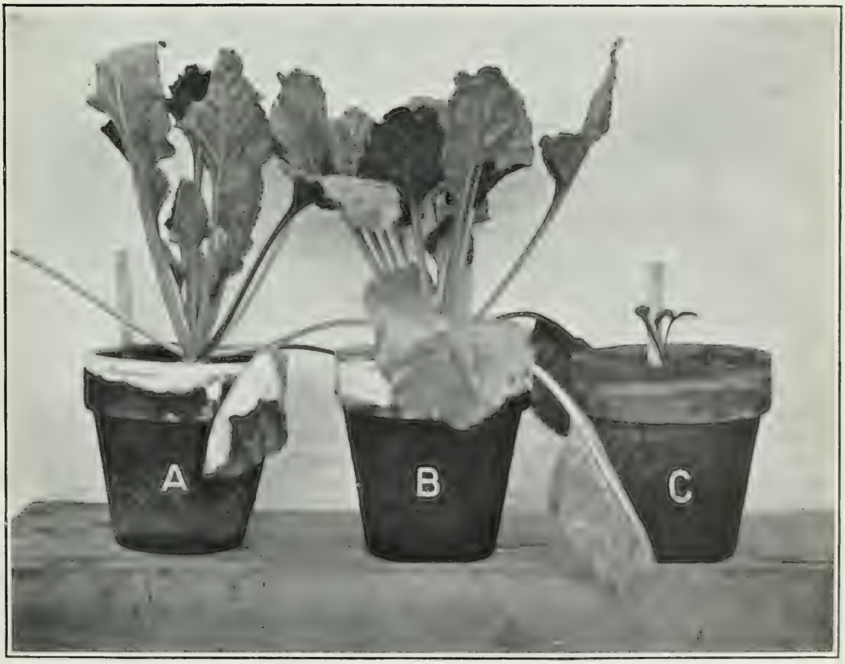


FIG. 2.—SUGAR BEET PLANTS THREE MONTHS OLD IN POTS, SHOWING THE EFFECT OF VARIOUS METHODS OF WATERING.

(About one-eighth natural size.)

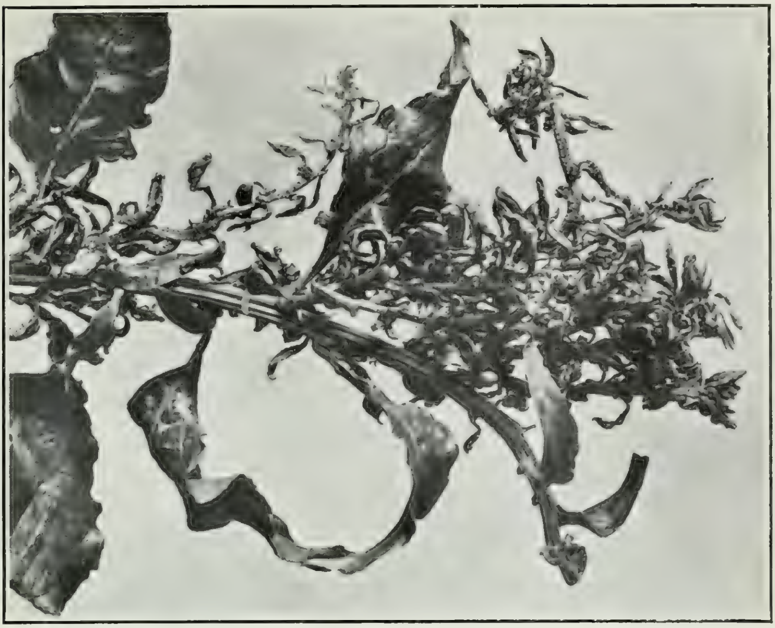


FIG. 1.—STEM OF SEED BEET AFFECTED WITH CURLY-TOP.

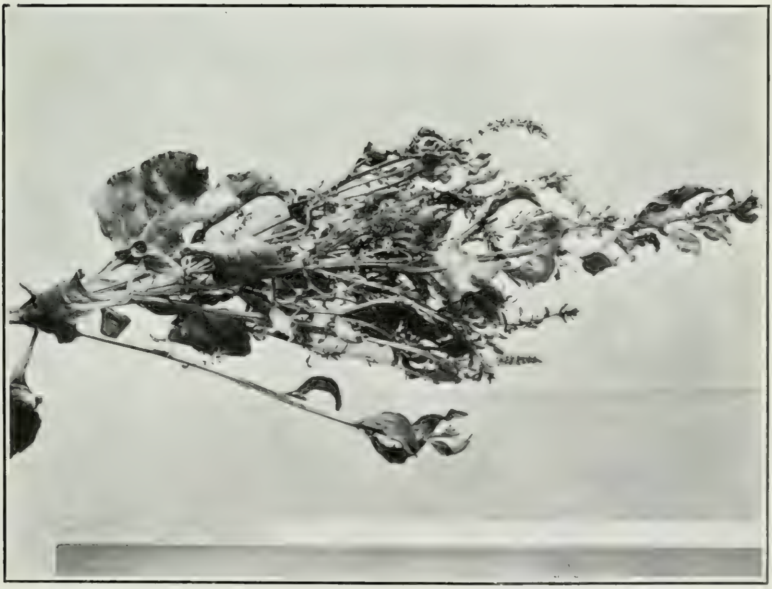


FIG. 2.—STEM OF HEALTHY SEED BEET.

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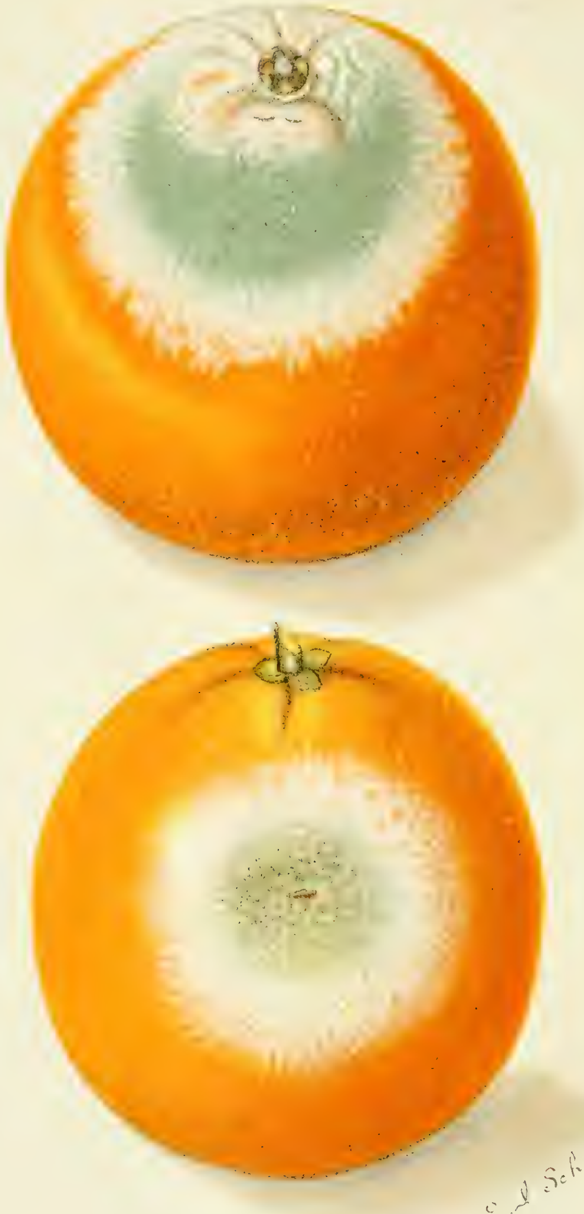

E. I. Schutt

WASHINGTON NAVEL ORANGES SHOWING BLUE-MOLD DECAY.

(Specimens considerably reduced in size)

BREUKER & KESSLER CO. PHILADA

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 123.

B. T. GALLOWAY, *Chief of Bureau.*

THE DECAY OF ORANGES WHILE IN TRANSIT FROM CALIFORNIA.

BY

G. HAROLD POWELL,
Pomologist in Charge of Fruit Transportation
and Storage Investigations,

ASSISTED BY

A. V. Stubenrauch, L. S. Tenny, H. J. Eustace, G. W. Hosford,
and H. M. White, of Field Investigations in Pomology.

Issued March 31, 1908.

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LETTER OF TRANSMITTAL.

United States Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., November 22, 1907.

Sir: I have the honor to transmit herewith a manuscript entitled "The Decay of Oranges While in Transit from California" and to recommend that it be published as Bulletin No. 123 of the Bureau series. It has been prepared by Mr. G. Harold Powell, Pomologist in Charge of Fruit Transportation and Storage Investigations, assisted by Messrs. A. V. Stubenrauch, L. S. Tenny, H. J. Eustace, G. W. Hosford, and H. M. White, all of Field Investigations in Pomology, and has been submitted by Mr. William A. Taylor, Pomologist in Charge of Field Investigations, with a view to publication.

The investigations summarized in this manuscript are unique in that they have involved the actual handling and careful inspection of large quantities of oranges through all the various operations to which the fruit is subjected in its progress from the trees in California to the markets in eastern cities. This has included the actual custody of numerous carload lots of fruit while in transit under different methods of railroad transportation. The investigations, in general, have been conducted on a commercial scale and under commercial conditions, with a view to securing accurate data regarding the practical requirements and needs of different phases of the industry, but the laboratory method has been applied to the fullest extent practicable under the conditions existing in the field, the packing house, the storage warehouse, the railroad car, and the salesroom.

The perishable character of the product under investigation, taken in connection with the physiological and economic factors involved in its harvesting, transportation, and sale, has apparently been responsible for much of the misapprehension that has hitherto existed regarding the causes of decay of California oranges in commerce. A satisfactory determination of those conditions has required continuous observation of large numbers of representative lots of fruits simultaneously at distant points. No individual producer or receiver has found it practicable to make such an investigation. In fact, it developed early in the investigation that the problems could be promptly and economically solved only through the development of an organized corps of scientific workers who could prosecute different phases of the work simultaneously in the producing sections, in transit, and in some representative eastern market, maintaining continuous communication by mail and telegraph, so that the conditions to which the various shipments of fruit had been subjected could be thoroughly understood. Such a corps of workers has been gradually built up in this work, and the results set forth herein are believed to fully justify this feature of the Bureau organization.

The present paper is the first formal and comprehensive publication of the results of these investigations. It should be stated, however, that the various branches of the industry have been informed from time to time regarding the progress of the work. This has been accomplished through addresses delivered before meetings of growers and of various organizations of warehousemen, refrigerating engineers, and railroad men, as well as through the personal contact of a large number of packing-house foremen with the experimental work. Occasional circular letters summarizing the conclusions reached have been sent to the individuals and associations interested.

Largely as a result of the thorough organization of the industry and the active cooperative spirit shown by the leading men in it, a prompt and general modification of methods has resulted and is still in progress. While the work is not yet complete, it is believed that the phases reported upon should be given wider publicity in all our orange-producing districts because of the bearing they are likely to have upon the handling of this and other fruits in commerce.

The accompanying illustrations are necessary to a full understanding of the text.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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B. P. I.—325.

THE DECAY OF ORANGES WHILE IN TRANSIT FROM CALIFORNIA.

INTRODUCTION.

Soon after the United States Department of Agriculture, through the Bureau of Plant Industry, began a study of the storage and transportation of fruit the orange growers of southern California requested that an investigation be made of the decay in citrus fruits while in transit to eastern markets. The losses from decay were estimated variously to be from $500,000 to $1,500,000 annually.

The financial importance of this large amount of decay to the orange grower and shipper, to the buyer, and to the orange-consuming public made an investigation of the possible causes desirable.

A general survey of the industry was made in 1904, and for six months in each year since, experimental investigations have been carried on in an extensive way in the groves, in the packing houses, in the cars in transit to the East, and in the markets.

As this investigation has been so closely related to all the operations of the California citrus-fruit business, a general account of the industry will be necessary for a proper understanding of the discussion of the causes of decay in oranges during shipment.

GENERAL DESCRIPTION OF THE CALIFORNIA CITRUS-FRUIT INDUSTRY.

The introduction of the Washington Navel orange in 1870 from Bahia, Brazil, by the United States Department of Agriculture under the name of the "Bahia" orange and the sending of two trees propagated from those introduced from Brazil to Mrs. L. C. Tibbets, Riverside, Cal., in 1873, mark the most important epoch in the history of citrus-fruit culture in California. There were many types of oranges growing in southern California at that time, most of which were descended from trees planted in the gardens around the old missions by the Spanish fathers. None of these oranges equaled the new

Navel orange. This orange was a prolific bearer, the fruit of fine quality, the flesh meaty, juicy, and seedless, and the skin of a texture that insured good shipping quality, of a rich deep-orange color. The trees were of medium size, which made the groves more manageable than those of the tall-growing seedlings. This variety was named by the Californians the "Washington Navel," in honor of the city from which it was sent to them.[a] (Pl. I.)

The Washington Navel was widely planted in southern California, the State acquired a world-wide reputation for its citrus fruits, and a new era in orange culture in America began. In 1906–7 the Washington Navel crop in California reached a value of $12,500,000, with a gross value, including freight and icing charges, of $20,000,000.

The two trees sent to California by the Department of Agriculture are objects of historic interest in the city of Riverside at the present time. One of the trees was transplanted by the city from the Tibbets place in 1903 and stands in a thrifty condition at the head of Magnolia avenue. The other tree, shown in Plate II, figure 1, was transplanted in May, 1903, with the assistance of President Roosevelt, to the court of the Mission Inn.

THE EXTENT OF THE CITRUS-FRUIT INDUSTRY.

The citrus-fruit industry of California has grown up gradually. It began to assume commercial importance by 1880, and in 1886 amounted to a thousand carloads of 300 boxes each. Between 1890 and 1895 it had grown to from 4,000 to 7,000 carloads annually, and from 1900 to 1907 to between 25,000 and 32,000 carloads annually, i. e., from 6,000,000 to 11,000,000 boxes, having a gross value of about $1,000 a carload, or from $25,000,000 to $32,000,000.

The lemon comprises from 10 to 15 per cent of the citrus crop. There are a few pomelos (grape-fruit) grown. Three-fourths of the oranges are of the Washington Navel variety, the remainder comprising the Valencia as the most important variety, with fewer of the St. Michael, Mediterranean Sweet, Thompson, Ruby, Maltese Blood, Jaffa, seedlings, and tangerines. There are probably from 60,000 to 70,000 acres of citrus fruits in California, distributed among 5,000 to 6,000 growers. From 90 to 95 per cent of the citrus fruits are shipped to markets outside of California.

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[a] The Washington Navel orange was first called "Bahia" by the late William Saunders, Horticulturist of the United States Department of Agriculture. This name has been adopted by the American Pomological Society and appears in its catalogue of fruits. The name "Washington Navel" is in almost universal use, however, and although of later origin than "Bahia" it will be used in this publication.

THE LOCATION OF THE CITRUS-FRUIT INDUSTRY.

The citrus-fruit industry has reached its greatest development in southern California, which is made up largely of the San Bernardino, San Gabriel, and San Fernando valleys. It has become most prominent in the foothill regions and lower lands extending down from the San Gabriel and San Bernardino mountains, which make up the Sierra Madre Range; in the Riverside district; at the base of the Temescal Range on the Corona bench, and in the Coast region in Orange and Los Angeles counties. There are smaller but not less favorable regions in Santa Barbara and Ventura counties, close to the mountains, and in San Diego County.

In recent years the industry has been developing north of the Tehachapi Range of the Sierra Madre Mountains, especially in Tulare, Kern, Fresno, and Butte counties, though oranges are grown to a limited extent in other fruit-growing counties in the central and northern parts of the State as well. The greatest development has occurred in Tulare County, where the annual production is now about 2,000 cars of oranges, mostly of the Washington Navel variety. New plantings have been made which under favorable conditions may increase the annual production in that section to 10,000 cars in the next few years.

The orange crop of northern California matures from four to six weeks earlier than it does in the southern part of the State, notwithstanding that it is from 200 to 500 miles farther north. This unusual condition is due to the topography of the Pacific coast. The large inland valleys of northern and central California lie between two great mountain ranges extending north and south. The Coast Range Mountains shut off the modifying influences of the sea, causing relatively higher night temperatures during the summer months than prevail in the southern part of the State.

CULTURAL CONDITIONS IN THE CITRUS-FRUIT BELT.

Citrus fruits are grown in California on many types of soil under an intensive system of orchard management. Irrigation is necessary except from December to April, when the rainfall usually occurs. As in other horticultural industries there has not yet been developed a uniform system of management in respect to the handling of the soil, the use of water, the application of fertilizers, or in the handling of the trees. In a general way, it may be said that the tillage is frequent and thorough during the season from March to August or September; that cover crops, especially winter vetch, Canada peas, and burr clover, are coming into general use as a winter covering and as a means of improving the condition of the soil; that pruning, except with the lemon, is not systematically practiced;

and that commercial fertilizers of various kinds are probably used more extensively than in any other orchard industry in the country, except in citrus-fruit growing in Florida.

The groves are variable in size, the smaller ones containing from 5 to 10 acres, the latter being a common unit of size. There are many of 15 to 20 acres or more, and the groves of some growers range from 100 to 200 or more acres. There are a few large companies and corporations engaged in the business, some of them having from 250 to 2,500 acres of citrus fruits.

A Washington Navel orange tree three years after planting is shown in Plate II, figure 2, and a typical view of orange groves in bearing is shown in Plate III, figure 1.

The harvesting of the Washington Navel crop begins in November in northern and central California, and extends to the middle of June or the first of July in southern California. The Valencia season opens the latter part of May and extends into the latter part of September or the first of October, the trees at that time bearing the crop to be harvested and the partly developed fruit for the crop of the following season. The other varieties of oranges are harvested from February to July. The lemon is picked from the same grove in practically every month of the year, although the largest part of the crop is harvested from November to May, a single tree generally containing fruit in all stages of development from the blossoms to the mature lemon.

METHODS OF HANDLING AND MARKETING THE CITRUS-FRUIT CROP.

The citrus-fruit growers of California are as a class men of high intelligence, and many of them are of large business experience and capacity. Cooperation in the handling of the citrus fruits is the corner stone on which many of the successful business practices rest. Among the various systems of marketing the fruit there have been developed some of the best examples of cooperative organization among fruit growers to be found in America.

These cooperative associations, organized primarily for the business of packing and distributing the fruit to market, handle from 70 to 75 per cent of the entire citrus-fruit crop.

There are also firms and individuals who pack, distribute, and sell fruit on commission for the growers. More or less of this fruit is sold f. o. b. cars in California, subject to inspection on arrival in market, or for cash f. o. b. cars in California, while some is consigned to distant merchants. There is also considerable buying of the fruit from the growers either by the pound or in lump in the orchard taken as a whole. There are a few growers and fruit-growing corporations who pack and market their own fruit. About 40 per cent of all citrus fruits shipped from California is sold at public auction in eastern markets.

Among the cooperative organizations, the California Fruit Growers' Exchange packs and sells through its own district agents in the markets somewhat more than 50 per cent of the entire citrus crop. This organization is formed to regulate the distribution of citrus fruits throughout the country and to give to its members the benefits that arise from its cooperative efforts of various kinds. This Exchange represents about 4,000 growers, who are organized into more than 80 local incorporated associations, the primary function of which is to prepare the fruit for market. The associations in the different producing regions combine into one or more local incorporated district exchanges or selling agencies, which sell the fruit through the district agents or at public auction and receive the money therefor through the medium of the California Fruit Growers' Exchange. There are 13 of these district exchanges. Each local district exchange selects a representative to act for it on the board of directors of the California Fruit Growers' Exchange, which is an incorporated body acting as an agency or clearing house for the district exchanges in the marketing of their fruit and which operates for the growers without profit to itself. It takes the fruit of the district exchanges after it is packed, and with their cooperation and advice places it in the different markets of the country, sells it, collects the proceeds, and turns them over to the district exchanges, which in turn pay the growers through the local associations. The California Fruit Growers' Exchange is the agency through which the grower is able to control the larger business problems and the general policy of the handling and marketing of the citrus-fruit crop.

An association, whether a part of the California Fruit Growers' Exchange or organized independently, is composed of a number of growers who are incorporated with a board of directors and officers for business management. The association usually owns its own packing house, where the fruit of the members is assembled and prepared for shipment, or the association may lease a packing house from a railroad. The fruit of an association is marketed in the name of the association or of the district exchange of which the local association is a part, in the latter case both the name of the local association and the district exchange usually appearing on the package.

The fruit of the growers of an association may be handled as an individual account, but the usual method is to ship the different grades of fruit of all the growers under brands selected for each grade, the individual grower losing his identity so far as the market is concerned when the fruit enters the packing house and has been graded. In handling the fruit in this manner, the shipping season is divided into periods varying from two to six weeks in length, and these periods are known as "pools." When a pool covers a month, it is referred to as a "January pool," "February pool," and so on. The members of the association are credited with the weight of each grade of fruit delivered, and at the end of a pool receive the pro rata of the proceeds represented by the quantity of fruit delivered to the packing house during that pool.

The responsibility of the association or of the individual or firm that packs and distributes or sells the fruit for a grower usually begins when the fruit is delivered at the packing house. The association in a general way controls the time of delivery of the fruit of its members to the packing houses and the proportion of their crop that shall be delivered at one time, giving each member an opportunity to furnish his pro rata of fruit during the marketing season, based on the relative percentage of his crop to the holdings of the association as a whole. Previous to the beginning of the investigation by the Bureau of Plant Industry little attempt was made to exercise control over the conditions under which the fruit was harvested and delivered for packing, but during recent seasons much careful attention has been given to these important operations.

In most cases the fruit is picked by the owner or manager of a grove, or by labor under his direction, the labor being paid by the box or by the day. Frequently the fruit is picked and carted to the packing house by contract at a fixed price per box or rate per hundred pounds. Among the cooperative associations and individuals or firms shipping for growers or buying for cash, a system of gang picking is growing in favor as a means of insuring greater uniformity in the condition of the fruit. A picking crew with a foreman is employed by the officers of an association, for example, and the fruit of the members of the association is picked by this crew. Under this system only skillful workmen need be employed and very efficient work is secured when the labor is directed by a competent foreman. Some association packing houses that do not have a picking gang employ a picking inspector, who sees that the fruit delivered by different growers to the packing house has been carefully picked.

The most uniform results are secured when the same labor is employed continuously. Since two or three pickings of oranges are made from the same tree during a season, this condition is not always practicable on the average ranch when the picking is done by the owner. Usually the owner has to secure such labor as is available for each picking, and often can not employ the same set of men more than once. This is especially true where the help is secured through labor agencies. Under these conditions there has been a lack of uniformity in the condition of the fruit from different groves and from the same grove at different pickings.

Among the laborers are found Americans, Japanese, Mexicans, Chinese, and a few of other nationalities. Experience has shown that the ability of the labor foreman is of more importance than the nationality of the crew in securing efficient work and that the general policy of those who employ the labor in respect to the care with which the fruit is to be handled is of greater importance than both.

PICKING CITRUS FRUITS.

In picking citrus fruits it is necessary to sever them from the branches with sharp clippers or shears. The fruit is then placed in a picking bag holding from 20 to 50 pounds, slung over the neck and shoulders of the picker. From this it is emptied into picking or lug boxes, and in these the oranges are delivered to the packing house. Sometimes the packing or shipping boxes are used for this purpose once before shipment. Formerly the most common type of shears in use was a small one with sharp-pointed, curved blades, shown in figure 1, A, which, when not handled with care, often punctured or cut the skin of the orange. Since greater care and attention have been given to the operation of picking, many new styles of clippers have been invented and put into use, most of them with rounded or blunt points. Blunt-pointed clippers are shown in figure 1, B, and another style, known as sheath clippers, in figure 1, C.

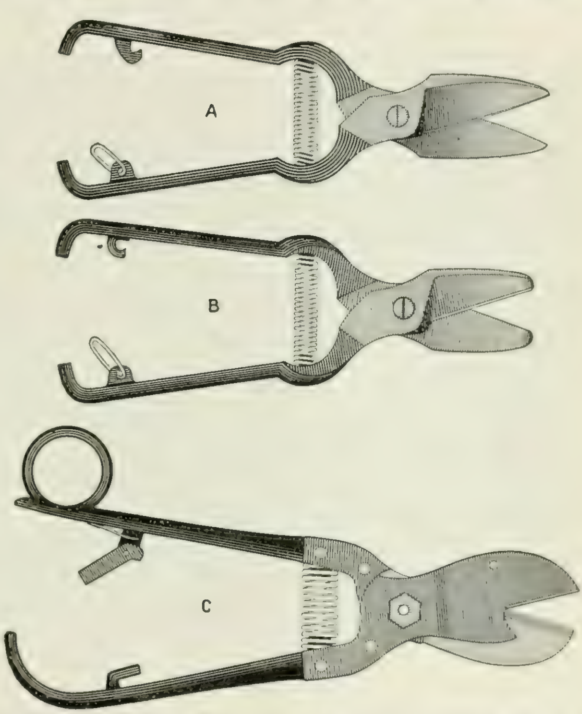

Fig. 1.—Types of shears or clippers used in picking citrus fruits. A, a sharp-pointed type; B, clippers with blunt points; C, sheath clippers.

PACKING CITRUS FRUITS.

The packing houses are located either on the ranches or at the shipping stations, usually at the latter points. Some of the large corporations and a few individuals have the fruit packed in houses on the ranch, but the association houses and those of the other types of shippers are generally placed alongside the railroad at the shipping point.

The houses vary in capacity from 1 to 15 carloads of fruit a day. The capacity of all the packing houses in California is said to aggregate from 400 to 600 cars a day, though the daily shipments do not average more than 150 cars during the main shipping season. In no other fruit industry have the appliances for handling the fruit in the packing house been so highly developed. The average orange packing house is equipped with box-making machines which nail together the boxes used for carrying the fruit to market; specially constructed hand trucks for moving several picking or shipping boxes at a time; hoppers for receiving the fruit; washing tanks and scrubbing machines to remove the sooty-mold fungus, and drying racks in those sections where the fruit has to be washed; elevators to carry the fruit to the grading and sizing machines, drying racks, and other places; carrying belts or chutes; automatic weighing and recording scales for weighing the different grades of fruit of each grower; series of padded bins, sometimes with self-adjusting bottoms, for receiving the different sizes of fruit; belts to carry the packed boxes; presses for covering the boxes; and sometimes a system of fans to assist in drying the fruit, and a machine to wrap the fruit automatically. All of the stationary machinery is run by power, making the interior of a large packing house in operation resemble the interior of a complex factory.

There is a wide variation in the type and arrangement of the different kinds of machinery. A general idea of the steps through which the orange passes may be gained from the following brief description of a common type of house. The fruit is dumped from the field boxes into the hopper (see Pl. IV, figs. 1 and 2), which leads to rapidly revolving brushes (Pl. IV, fig. 1) which clean the fruit. From the brush the fruit is elevated to a sorting or grading table or grading belts, figure 2, where it passes before the grader and is sorted into two or more grades by hand. Each grade then runs by gravity or on belts through an automatic weighing machine (Pl. V, fig. 1), where the weight of the grades of each grower is recorded, to the long sizing machine (Pl. V, fig. 2), and from there, in various ways, to the packing bins seen in Plate VI. If the fruit is to be washed, it is first dumped into a tank of water; then run between brushes submerged in the water (Pl. VII, fig. 1) or with water running over them; then elevated or run to drying racks (Pl. VII, fig. 2) or under a blast of air, after which it is usually run through all the steps described for brushed fruit, or the hopper and brush may be left out and the oranges delivered to the sorting table. There is a wide difference in the simplicity or complexity of arrangement of the packing houses and a similar variation in the speed with which the machinery is operated. A complex, undesirable type of house is shown in Plate III, figure 2, while a simpler and desirable arrangement of the machinery is shown in Plate VI.

The packing of the fruit is done by men or women, the laborer being paid usually by the box, though sometimes by the day. The packers average from 40 to 100 boxes for a day of ten hours.

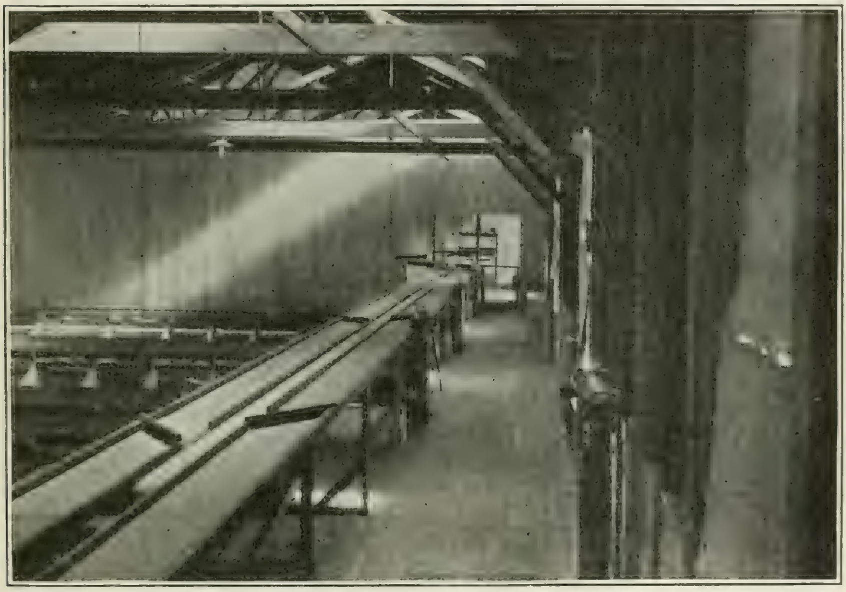

FIG. 2.—Grading belts used in assorting oranges.

The grading of citrus fruits is based on the general texture of the skin of the fruit, on its appearance as influenced by scars, and on the general form and style of the fruit. The grades have no reference to the size of the fruit. There are usually three grades packed—"Fancy," "Choice," and "Standard." Some packers also have so-called "Extra fancy" and "Extra choice" grades. A "Fancy" orange is supposed to have a deep orange color, to be normal in form, fine in texture, with freedom from blemishes, and heavy and juicy. A "Choice" orange is supposed to have good color and good but not the finest texture. It may have a few blemishes. It should be free from frost damage and should be reasonably heavy and juicy. A "Standard" orange may be quite badly scarred or discolored, coarse in texture, and irregular in form, but should be merchantable shipping stock. Many frozen oranges are shipped as "Standards." A fourth grade, "Culls," is sold to the peddlers from the packing houses and is sometimes shipped to near-by markets. Many of the shippers are discarding the "Fancy" and "Choice" grades and pack a grade called "Orchard run," which represents the fruit of the orchard with the "Standards" and "Culls" out. The grades are usually shipped under brands which are selected for the different grades and not under the designation "Fancy," "Choice," or "Standard." The name "Orchard run" is frequently used as a brand designation for that grade.

Each grade of oranges is divided into sizes, the extreme range of sizes varying from 48 to 420 oranges to the box. The most desirable commercial sizes of the Washington Navel variety are in boxes containing 150, 176, 200, and 216 oranges. A standard box of California oranges is 12 by 12 by 26 inches outside measurement, divided in the middle by a partition, with an inside fruit space of 11½ by 11½ by 24 inches. A box of oranges is estimated to weigh 72 pounds.

A car of Washington Navel oranges, so far as the sizes are concerned, may contain boxes of all of the sizes. A car is called a "standard car" when it contains not more than 10 per cent of each of the following sizes—96, 112, and 250, and not over 20 per cent of the 126 size. The remainder of the car may be divided among the 150, 176, 200, and 216 sizes. If a car is sold to a dealer at a fixed price per box, it is usual to allow a discount of 25 to 50 cents per box on the excess in the 96, 112, 126, and 250 sizes, and a discount of 50 cents per box on the 48, 64, 80, 288, 300, 324, 360, and 420 sizes. The rule regarding the sizes in a standard car may vary with the season, with the section, and with the general size of the fruit taken as a whole. When oranges of either the large or small sizes are scarce they are at a premium, and the proportion in a car may be raised without discount.

SHIPPING CITRUS FRUITS.

The citrus fruits of California are distributed to markets throughout the United States and Canada, and to a limited extent to European and other countries. They are shipped under a specially organized refrigerator-car service. From November to the middle of March, during which period about one-half the crop is moved, the weather in California and throughout the territory en route to distributing points is cool and shipments are made under ventilation without ice, the ventilation of the cars being regulated by the railroad under instructions from the shipper. After the middle of March cool weather in California or in transit can not be relied upon and ice is quite generally used for refrigeration, though some shippers forward the fruit much later under ventilation. Early in the season, especially during January and February, when the fruit is packed in a cool condition, it may be frozen in transit unless special precautions are taken to protect it by insulating the car with building paper or other materials, by raising the boxes on strips above the floor, and by regulating the ventilators carefully according to instructions. Occasionally after the middle of March the fruit may be loaded at a temperature of 80° to 100° F., but a large proportion of it is packed at a temperature not above 65° F. even as late as the first of June.

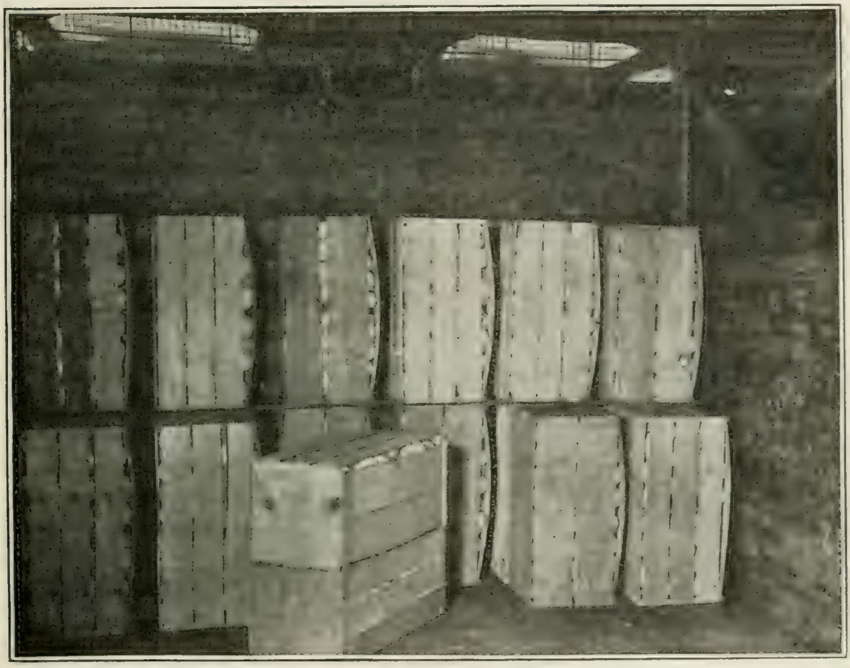

FIG. 3.—Boxes of oranges in a car, showing the standard method of loading.

A standard car 40 feet in length usually contains 384 boxes of oranges loaded two tiers on end and six rows wide, as shown in figure 3. The boxes are billed at an estimated weight of 72 pounds each. The minimum freight weight of a car over 37 feet in length, outside measurement, is 26,700 pounds. The minimum freight weight of a car 37 feet or less in length is 24,190 pounds. The freight rate varies from $1.12½ to $1.50 per hundred pounds when shipped in carload lots. To most points on the Missouri River and eastward there is an emergency rate of $1.15 per hundred pounds in carload lots, effective since March 11, 1907, the former rate being $1.25 per hundred pounds.

In 1907, when there was serious shortage in the supply of cars, many were loaded seven rows wide on the bottom tier and six wide on the top tier as a temporary expedient, thereby increasing the customary load an appreciable amount.

Each of the two ice bunkers of a refrigerator car, one at either end, holds from 2 to 2½ tons of ice. The first icing of the cars is done at various assembling points in California after the fruit is loaded, and reicing in transit follows as needed. The average time in transit from southern California points to New York is twelve to fifteen days, and to Chicago from nine to eleven days, the time, in general, depending on the condition of the transportation business of the western railroads and their connections. The carload rate on refrigeration is based on the section of the country into which the car is shipped and the weight of fruit in a car. The rate to Chicago, for example, on a car of 24,190 pounds is $54.67 and to New York $65.61. The rate on a car of 27,650 pounds, which is the weight of a standard car of 384 boxes, is $62.50 in the former case and $75 in the latter.

THE INVESTIGATION OF THE CAUSES OF DECAY.

The investigation by the Bureau of Plant Industry was begun as the result of the efforts of Mr. J. H. Reed, an orange grower of Riverside, Cal., who, on account of the interstate nature of the problem, endeavored to induce the Department of Agriculture to undertake this work. In the winter of 1903–4 a preliminary survey of the orange industry was undertaken to make plans for this investigation. The causes of the decay were not understood, but a multitude of theories were advanced by growers and shippers to explain it. Some attributed the decay to the influence of the type of soil and to other conditions under which the fruit was grown; to a possible degeneracy in the fruit as the trees grew older, and to climatic conditions, such as frequent fogs and rains. The decay was thought by many to be especially related to a supposed inherent weakness of the fruit during the blooming period of the trees, which occurs during the picking season. Others believed it to be due to methods practiced in the packing houses, while nearly all were more or less agreed that a large part of the loss was chargeable to inadequate or improperly handled transportation facilities. The decay entailed a heavy loss on the shipper, it was detrimental to the reputation of the industry, and it led to difficulties of various kinds between all parties concerned in the handling and transportation of citrus fruits.

The preliminary survey in the winter of 1903–4 showed that the decay was more troublesome in some regions than in others, that it was worse in some packing houses than in others in the same region, and that it usually increased in severity as the season advanced. Continual observations on many of the popular and supposed causes did not give promise of a satisfactory explanation, but it was noticed from the beginning that there was a close and constant relation between the various methods of handling the fruit and the development of decay.

THE BLUE MOLD OF CITRUS FRUITS.

The common blue-mold fungus was always found to be associated with decaying oranges, as was observed in 1905 by Woodworth.[a] This fungus grew within the tissues of the fruit and caused a breaking down of the structure, which rapidly produced a soft decay of the entire fruit. Two distinct kinds of growth were constantly found. The most common grew rapidly in a rather indefinite area over the orange, producing a mass of olive-green spores, with a large area of white mold extending beyond the spores and producing a semisoft condition of the fruit. The growth of the second was much slower and in a more definite area, and the spores were bright blue in color, though in other respects this fungus was similar to the first.

Both fungi have been determined as species of Penicillium. While a distinct difference can be seen in the growth of the two in producing decay in the orange, it has been difficult to separate them morphologically. *Penicillium glaucum* has been generally considered the most common of the mold fungi. Yet, on the orange the rapid-growing, olive-green fungus is referred to as *Penicillium digitatum*, and the slow-growing, bright-blue species as *P. glaucum*.[b] The more common form is shown in Plate I, frontispiece. The spores are produced in countless numbers on the decaying fruit, of which there is always more or less in the groves and in and around the packing houses. They are on the fruit, on all the machinery, and floating in the atmosphere, and they germinate easily and quickly wherever the conditions of heat and moisture are favorable.

That there might be no question about these molds being the cause of the decay, large numbers of fresh, sound oranges were inoculated both in the field and the laboratory with spores of these species, and without exception the characteristic decay resulted.

These fungi had always been considered as saprophytic—i. e., capable of growing only upon dead organic matter—and from previous investigations with apples in storage it had been determined that fungi of this group were apparently incapable of penetrating the unbroken epidermis of a healthy fruit and causing decay.

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[a] Woodworth, C. W. Orange and Lemon Rot, Cal. Agr. Expt. Sta. Bul. 139.

[b] Smith, Ralph E. The "Soft Spot" of Oranges, Botanical Gazette, vol. 24, p. 103.

Smith, Ralph E., et al. The Brown Rot of the Lemon, Cal. Agr. Expt. Sta. Bul. 190.

Upon careful examination of a large number of oranges in which the rot was just starting, it was seen that the area of decay in most cases was around a place where the epidermis had been previously injured by a cut or abrasion of some kind. Not all fruits in which the epidermis had been injured showed decay, nor could the decay always be traced to an abrasion in the skin. Injured fruit that was exposed to a free circulation of air did not usually develop a large amount of decay. The moving air quickly evaporated the moisture which accumulated in the injured tissue, making conditions unfavorable for the germination of the mold spores and the subsequent development of decay.

The effect of different kinds of cuts and abrasions on the fruit appeared important. A slight puncture or the removal of bits of the epidermis by scratches or by shaving it with the picking shears would frequently dry before spores could germinate and become established. A deeper wound, especially in the body of the fruit, where the skin is thin, would usually fill with juice and provide ideal conditions for rapid decay. It was noticed that decay did not develop in these slight wounds, while it was almost sure to develop in the deeper wounds unless the fruits were held in an unusually dry or cold atmosphere.

These observations were followed by a series of laboratory studies by Mrs. Flora W. Patterson, Mycologist of the Bureau of Plant Industry, who found that the blue-mold fungus did not have the power of penetrating the epidermis of a sound, healthy orange even under conditions of heat and moisture that were most favorable for the growth of the fungus. Practical applications of these laboratory tests were made with oranges under ordinary packing-house conditions. Without puncturing the skin, the mold spores were placed on the surface of oranges which had been delivered at the packing house in the usual commercial way and were apparently sound. This fruit was held for one or two weeks in the house, where conditions were favorable for the germination of the spores and for the development of decay, and then examined. It was rare to find that decay had developed at the point where the blue mold had been placed on the fruit. Decay, however, sometimes developed where no mechanical injuries were visible. In these cases, the mold probably entered the skin through injuries caused by the punctures of insects, by the dropping of the fruit, or through other injuries not discernible.

The power of the fungus to grow in healthy oranges in commercial cold storage has been tested by inoculating fresh fruits with the mold spores in a puncture through the epidermis and placing them at once in a temperature of 32° F. or less. Decay had not developed in two months, when the tests ended. When the decay is established and developing in an orange, it does not appear to be entirely checked when placed in a temperature of 32° F., though the development is greatly retarded.

MECHANICAL INJURIES RELATED TO THE HANDLING OF ORANGES.

In the spring of 1905 a systematic series of observations and inspections was inaugurated to determine the amount and severity of mechanical injuries of oranges when delivered at the packing houses and the relation of the methods of handling the fruit to these injuries.

This was accomplished by a close inspection of many thousand fruits in a large number of packing houses and groves in different sections, and included an examination of the oranges of different growers delivering fruit at the same house and of the work of different pickers working in the same grove.

It was soon discovered that fresh mechanical injuries could be seen on a considerable proportion of the fruit. The most common type of injury was made by the point of the clippers in cutting the oranges from the trees. In some cases deep gashes had been cut into the skin, in others the skin had been shaved or sliced off in areas varying in extent, while in still others the injury was so slight as to be hardly perceptible. Many of the oranges were severely injured by stem punctures, which are produced when an orange cut from the tree with a long stem is allowed to fall or roll forcibly against another fruit, while others showed scratches of various kinds and punctures from thorns. Other common forms of injury occurring in the groves were punctures and bruises from gravel and twigs in the bottom of the picking boxes and cuts in the skin caused by the finger nails of the pickers. Frequently bruises were found that could be traced to rough and careless work in loading and carting the fruit from the groves to the packing house and in unloading. It was found that there was often a wide difference in the amount of this injury in the fruit delivered by different growers to the same packing house, and there was as great a variation in the condition of the fruit in different picking boxes coming from the same grove. Very often there was considerable injury that could be traced to some incidental derangement in the packing-house machinery, such as a broken wire in a wash tank, a protruding screw among the bristles in the brushing machines, a nail or bolt extending into a chute or runway, or some other similar defect. (See Plate I.)

A large number of records of these different types of injuries has been secured during the past three years. It is not possible to include these records in full in this publication, but the following representative statistics will give an idea of the extent of this trouble.

THE EXTENT OF THE MECHANICAL INJURY OF THE ORANGE.

In 1905 the average amount of mechanically injured fruit, based upon a careful inspection of more than 40,000 oranges during January and February, was 17 per cent. On February 27, 1905, a circular was issued calling attention to this injury and its relation to decay and suggesting methods whereby it could be reduced. Apparently the growers were quick to adopt ways of reducing the injury, for after the 1st of March it did not exceed 7.5 per cent—an immediate reduction of nearly 10 per cent.

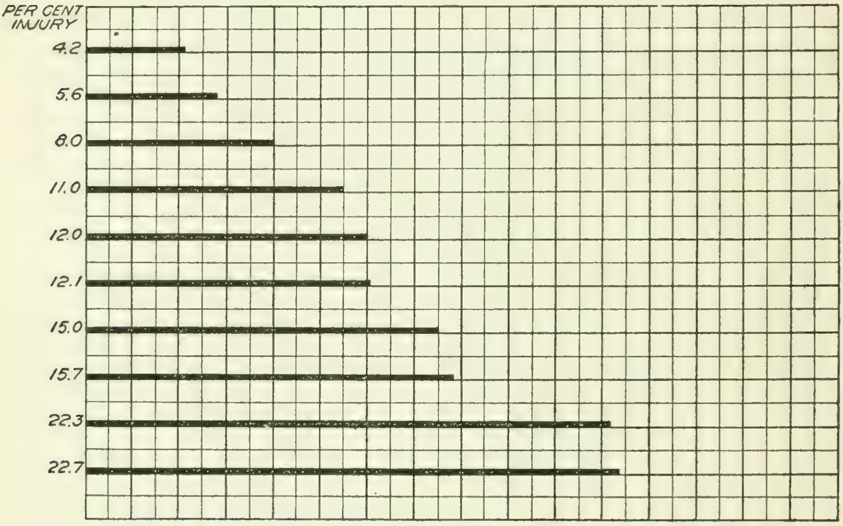

FIG. 4.—Diagram illustrating the average amount of mechanical injury in oranges in ten packing houses.

The accompanying chart (fig. 4), computed from the data of 1905, shows the variation in the amount of injury in the fruit found in ten different packing houses.

The chart shown as figure 5, page 25, also computed from the records of 1905, shows the variation in the amount of injury in the oranges of ten different growers who delivered and pooled their fruit together in the same packing house.

The fruit of an individual has sometimes shown 50 per cent or more of mechanically injured oranges.

The variation in the quantity of fruit injured by ten different pickers in the same grove is brought out in figure 6 (p. 26), computed from the records of 1905.

Occasionally pickers have been found who have injured from 50 to 75 per cent of the fruit they picked.

A large quantity of fruit has been examined in the bins and packed boxes in many packing houses to determine whether the oranges that are injured are seen and removed by the graders, as it was generally maintained that this was done. Figure 7 (p. 27) shows the percentage of injured fruit in ten representative lots.

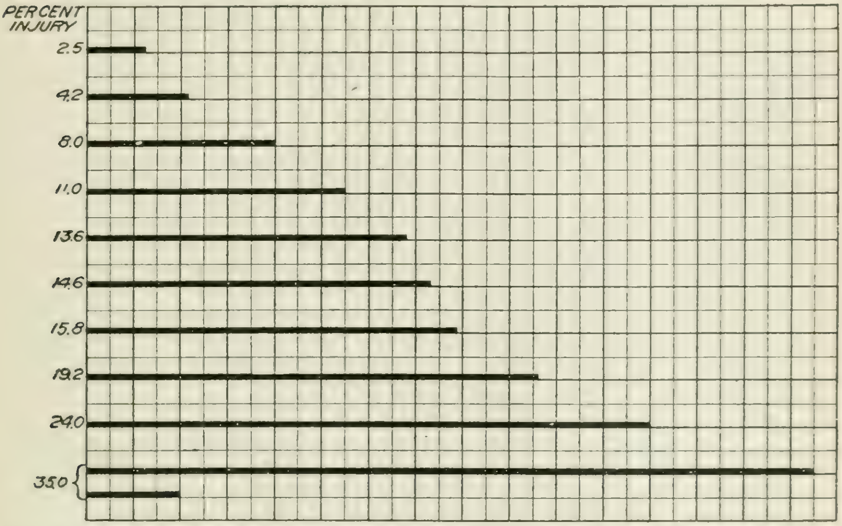

FIG. 5.—Diagram illustrating the average amount of mechanical injury in oranges of ten growers who pooled their fruit.

It was an exception to find a grader who could see and throw out an orange showing a slight mechanical injury. It is probable that 95 per cent of the fruit injured in handling is included in the packed fruit.

GROWERS AND PACKERS NOT AWARE OF THE EXTENT OF MECHANICAL INJURY.

The most experienced growers and packers were not aware of the extent to which the orange was injured in handling, nor did they appreciate the effect of a slight bruise or abrasion on the keeping quality of the fruit. In a general way, it was known that an orange with a punctured skin was likely to decay, and the need of handling the fruit carefully was discussed abstractly but with little appreciation of the importance of careful handling to the preservation of an orange. The greatest amount of injury was frequently found in the fruit of individuals who were skillful growers and who gave careful attention to all the necessary details of production, but who did not know or understand the importance of careful picking. The same failure to appreciate the importance of care in handling was even more pronounced in the case of the laborers who did the picking. They did not know they would cause the decay of the fruit by cutting the skin or allowing it to drop into the picking sack, or that they were actually causing so much injury to the fruit.

Since it was desirable to have all the persons interested realize the large quantity of fruit that was injured by handling, the inspections of the oranges in the groves and packing houses have been made in full view and with the cooperation of the most interested growers and packers. The relation between an injury to an orange and the chance of decay during shipment is now generally understood by growers and packers, largely as a result of these demonstrations.

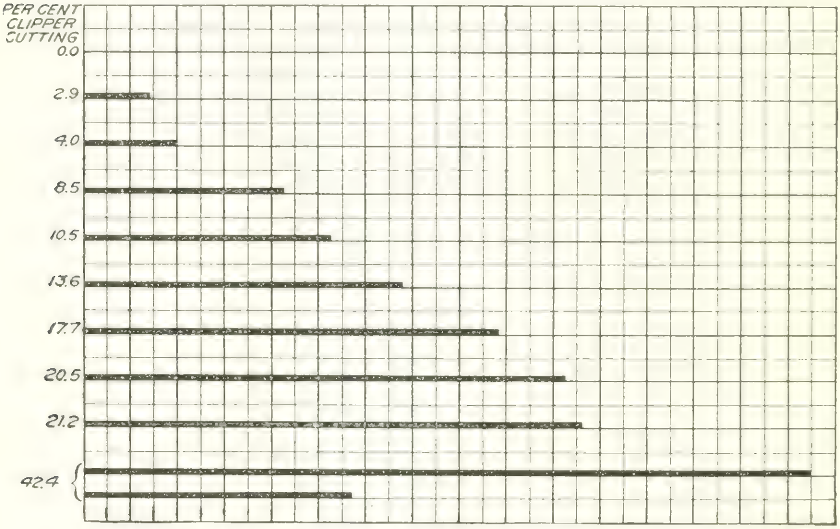

FIG. 6.—Diagram illustrating the average quantity of fruit cut by ten pickers in the same grove.

As a result of this understanding, it is now accepted without question that the elimination or reduction of the mechanical injury of the orange in handling is one of the largest problems that the California citrus-fruit grower and packer have to overcome. A determined effort is being made to reduce the trouble, and abundant data have been accumulated to show that by using care in the instruction and supervision of labor not more than 2 or 3 per cent of the oranges will be injured in handling the fruit on a large commercial scale.

The following data are presented to show that it is practicable to handle the orange without mechanical injury to the fruit. These figures show the result of 10 inspections of fruit from 1905 to 1907, inclusive, of a corporation handling several hundred acres of groves. The first inspection was made before the circular of February 27, 1905, was issued.

Percentage of mechanical injury to fruit found in a large orange grove at each of ten inspections during 1905-1907.

First inspection.	Second inspection.	Third inspection.	Fourth inspection.	Fifth inspection.	Sixth inspection.	Seventh inspection.	Eighth inspection.	Ninth inspection.	Tenth inspection.
15.8	2.6	0.4	1.1	1.2	3.3	5.5	0.3	3.0	0.0

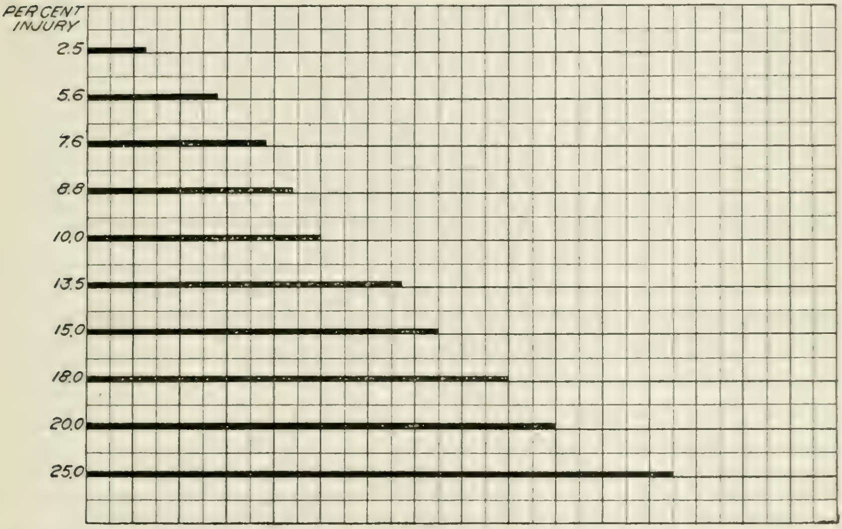

FIG. 7.—Diagram illustrating the average quantity of injured oranges found in bins or packed boxes.

THE INJURY OF THE FRUIT AN ECONOMIC PROBLEM.

After a careful study of the problem for three years, it is evident that the mechanical injury of the orange is partly inherent to the handling of a perishable crop, but that it is primarily related to the economic and social conditions surrounding the citrus-fruit industry. It is related to the large volume of business handled by growers and packers, to the character and quantity of the labor available, to the system of handling the labor, to the details of packing-house management, to the aim of the association and packer who handle the fruit, and to the effect of sharp competition between those who handle the California citrus-fruit crop.

The industry has reached its present condition through gradual development. The one factor in this growth that stands out with prominence as a fundamental cause of careless handling is the effort to handle large quantities of fruit at the lowest possible cost. By having the fruit picked and packed by the box and by having other operations performed on the same principle, there have been developed labor methods, packing-house equipments, and systems of business practice that place a high premium on the quantity rather than the quality of the work accomplished. The payment of labor by the box has developed a class of pickers whose chief aim is to pick the greatest possible number of boxes. It is not unusual to see the professional picker, with a hoop fastened in the top of the picking sack to hold the mouth open, with a deft movement of the clippers cut the oranges and shoot them directly into the bag. Such effort led to the use of sharp-pointed clippers, or shears (fig. 1, a), which the picker could handle with great facility. It has developed the type of packing-house equipment shown in Plate III, figure 2. It is responsible for overcrowding the capacity of the average packing house, for the excessive speed of machinery, and for a general feeling among growers and packers that the continuous reduction in the fixed charges in the handling of the crop in California from year to year is an essential in successful orange handling. It is a common occurrence for a grower to change the agency for handling his fruit to another that will do it for a fraction of a cent a box less, the immediate saving being the factor that determines his action. There is an equal rivalry between the packing houses to reduce the cost of handling the fruit, and a similar desire to have it sold at the lowest charge for handling.

A REDUCTION IN THE COST OF HANDLING A PERISHABLE PRODUCT NOT ALWAYS JUSTIFIABLE.

The tendency to reduce the cost of producing and handling a crop is commendable from a business point of view. Probably no other fruit industry has reduced the necessary cost of handling and marketing the crop to such an extent as the citrus industry, largely as a result of the effective cooperative organization of the fruit growers. But in the handling of a perishable commodity it is false economy to reduce the cost of an operation if the change is detrimental to the keeping quality or attractiveness of the product. A laborer who picks 100 boxes of oranges a day at 3 cents a box, cuts 25 per cent with the clippers, and drops the fruit several feet into a bag is more expensive to the grower than one who picks 40 boxes for $3 but places the fruit in the picking boxes in sound condition. It is equally false economy to have the oranges packed at low cost in a house where the handling of the fruit is so rough and complicated as to make it susceptible to decay before it is loaded for shipment. The real economy of reducing the cost of an operation is determined by the effect on the keeping quality of the product. Every reduction that is made at the expense of the shipping and keeping quality of the fruit is not a saving to the industry, but in the end acts as an increase in the cost of handling by reducing the value of the fruit. Later in this bulletin it will be shown that the highest net returns in the citrus industry have followed an increased cost to insure a more careful handling of the product.

A WEAK POINT IN THE PRESENT METHOD OF HANDLING THE ORANGE.

There is another factor related to the cooperative method of handling, as well as to the method of handling the fruit by buyers and shippers, that is responsible for a large amount of rough handling. Neither the association, the shipper, nor the buyer can insure the careful handling of fruit where the picking and hauling are in the hands of the growers or of their representatives. In a general way, the packing association or shipper can advise the grower how to pick and haul the fruit, and lots of fruit that have been grossly mismanaged may be rejected; but it is impossible to insure a uniform condition in the fruit of different growers under these conditions. There is little incentive for the grower to handle his fruit with unusual care if it is to be pooled with the fruit of other growers who handle it carelessly. The tendency is for all growers to handle the fruit with but average care and for the careless grower to depend on a higher average handling by others to overcome the shiftless methods on his ranch. It is the tendency also for the average grower whose fruit is packed and sold for him by a dealer or agent to reduce the cost of picking and hauling the fruit to the packing house to the lowest possible figure, and if the fruit decays as a result of this bad handling to attribute it to the methods employed by the dealer or agent in packing and selling the fruit. A cooperative association or a dealer who handles the fruit for the growers either under a pooling system or for individual account needs to establish a standard condition as to freedom from mechanical injury of the fruit that enters the packing house and to provide a practical method of enforcing the requirements.

METHODS OF INSURING A UNIFORM CONDITION OF THE FRUIT.

There are at least two methods that may be adopted as a means of insuring a uniformly small percentage of injury in the fruit of different growers. The first is the picking of the fruit by gangs of laborers under the control of the packing-house management. A number of cooperative associations and independent shippers have recently adopted this method of handling the fruit. The success of this plan depends on the cooperation of the growers, a tactful and efficient labor foreman, and the strong support of the foreman by the packing-house management to the end that the fruit may be picked carefully and economically. If the growers do not accept this plan cheerfully, if the picking foreman is inefficient, or if the packing-house management insists on reducing the cost of picking without regard to the effect on the condition of the fruit, such a system is doomed to failure.

A second, though less certain, means of securing a uniform condition of the fruit is by a system of inspecting the fruit in the groves and as it comes to the packing houses, in order that the persistently careless picker and grower may be located and advised as to the means of reducing the injury, and finally eliminated if his fruit does not reach the required standard. This system has already been adopted by a number of association houses and by a few independent shippers.

EXPERIMENTS WITH DIFFERENT METHODS OF HANDLING ORANGES.

The experimental investigation of the causes of decay in oranges has been conducted with a view to determining the following points: (1) The comparative susceptibility to decay of oranges handled in different ways for shipment after holding the fruit in the packing houses in California about two weeks; (2) the comparative susceptibility to decay of oranges handled in different ways for shipment when forwarded to New York under ventilation, icing, and precooling; (3) the comparative susceptibility to decay of oranges handled in different ways and shipped under different conditions, the decay being determined at intervals during a storage of the fruit in a common storage room in eastern markets.

Technical investigations in refrigeration, including the development and testing of various methods of cooling the orange for shipment and a determination of the changes in the temperatures of cars during the transcontinental trip when shipped under different methods, such as ventilation, icing, and precooling, have also been made.

THE EXPERIMENTS WITH ORANGES STORED IN PACKING HOUSES.

The primary object of the experiments with oranges stored in packing houses was to determine, under conditions that permitted the growers and packers to see the results, the comparative susceptibility to decay of fruit that had been handled in different ways. A secondary object was to determine the comparative amount of decay in oranges handled similarly in different regions of the citrus-fruit belt.

The method of conducting these experiments was to select a quantity of apparently sound oranges from the picking boxes just as they were received from the grove, designating this lot as "unbrushed;" another lot of apparently sound fruit that had been run through the brushing machine and selected from the packing bins was designated as "brushed;" a third lot selected from either the drying rack or the packing bins, or that had been especially washed, was designated as "washed," and a fourth lot, in which each orange showed a visible injury, such as a clipper cut, punctures of various kinds, or other abrasions, was designated as "mechanically injured." In 1907 a comparison was made between the amount of decay of oranges washed in clean water and fruit washed in dirty water, similar to that used in commercial washing, or in clean water in which some blue-mold spores had been mixed. Several boxes of fruit of each lot were packed at one time and the fruit was left in the packing house for about two weeks, when it was examined for decay in the presence of growers and shippers.

These experiments were started in 1905 in 6 houses. In 1906 they were carried on in 15 houses and in 1907 in 31 houses. The experiments were usually begun in January and extended into April.

The work of the three years has shown that the orange as it comes from the tree in sound condition seldom develops decay and that brushing, washing, and the mechanical injury of the fruit in handling are followed by more or less loss, the greatest decay developing in the mechanically injured oranges.

The following table gives the average decay in the different lots of fruit in the three years. The data of 1907 appear also in figure 8, page 32.

TABLE I.—*Average percentage of decay found in oranges subjected to various methods of treatment and in various conditions, held in packing houses in 1905, 1906, and 1907.*

Year.	Treatment or condition of oranges.				
	Unbrushed.	Brushed.	Washed in clean water.	Washed in dirty water.	Mechanically injured.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1905	4.9	10.3			29.0
1906	1.5	4.7		10.3	36.8
1907	2.9	6.6	3.9	17.8	40.1

It should not be inferred from these figures that the unbrushed fruit in 1906 was less susceptible to decay than in 1905 or 1907. The fruit used in the experimental work was selected not by microscopic examination, but by an inspection not more critical than a careful fruit grader could make. The fruit that appears to be sound may nevertheless be bruised to some extent, and although the bruises are not easily perceptible they are severe enough to be followed by the blue-mold decay. The inspection in 1905 was probably not as critical as the work that followed, on account of the comparative inexperience of the Department representatives. The important principle underlying these figures is that an apparently sound orange when it comes from the tree shows greater resistance to decay than the same fruit after it has been handled in different ways, that the fruit showing visible mechanical injury as a result of handling develops the maximum decay, and that the brushing and washing of sound oranges is more or less detrimental to their keeping quality.

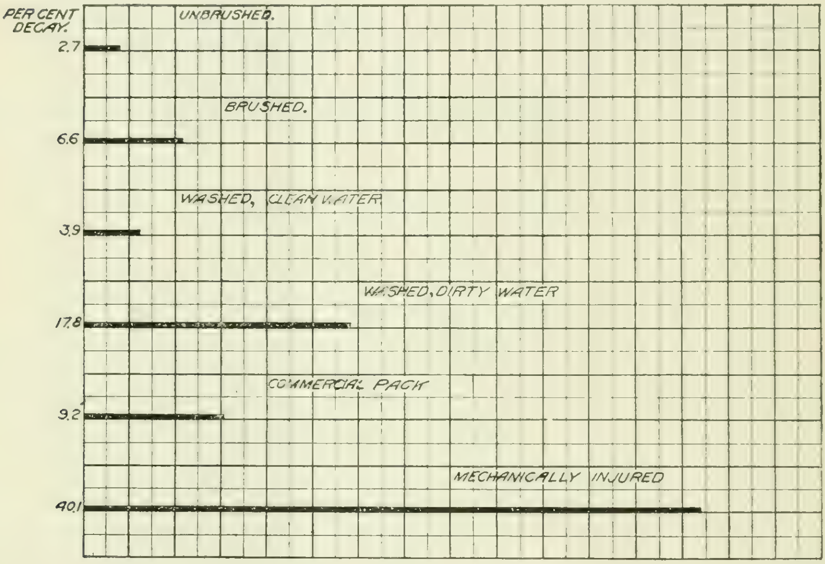

FIG. 8.—Diagram illustrating the percentage of decay in oranges held in packing houses, 1907.

Aside from these experiments, a number of comparisons have been made to determine the effect of dropping an orange 18 inches into the picking box. The data along this line are not extensive or conclusive, but they show that under some conditions the decay may be considerably increased by dropping the fruit a small distance.

THE DECAY IN ORANGES IN DIFFERENT SECTIONS.

The impression is general among growers and shippers in California that there is a wide difference in the inherent keeping quality of the oranges of different sections. The fruit from the upper San Bernardino Valley, for example, is usually said to have better shipping qualities than the oranges grown in the more humid regions near the coast. As a matter of fact, the average condition of the fruit of these two regions on arriving in market probably conforms to this general impression. The results of the packing-house tests already referred to indicate that the difference in shipping quality is due more to the conditions under which the fruit is handled in these sections than to the inherent character of the fruit itself. By comparing the experiments conducted in a group of houses on the coast with those in a group in the upper San Bernardino Valley, the following average result appears:

TABLE II.—*Average percentage of decay found in oranges in different sections of southern California subjected to various methods of treatment and in various conditions.*

Locality where grown.	Treatment or condition of oranges.				
	Not brushed.	Brushed.	Washed in clean water.	Washed in dirty water.	Mechanically injured.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Upper San Bernardino Valley	3.0	4.9	4.7	23.1	36.0
Coast region	3.1	9.1	5.2	16.2	51.1

There is practically no difference in the decay in the unbrushed fruit in the two regions. This shows the keeping quality of the sound fruit just as it comes from the tree. There is some difference in the brushed fruit, as the same types of brushes are not used in both sections, nor are the brushes always handled with equal care. When the fruit is washed in clean water the results are similar, the condition of handling in this case being similar and comparable. There is some difference in the decay in the mechanically injured fruit and in the oranges washed in dirty water, as the nature of the injury and the amount of blue mold in the dirty water were probably not comparable. These differences in decay are no greater than commonly occur in different experiments in handling the same type of fruit in the same house.

In order to compare the influence of the brushing of the fruit under similar conditions, the tests in the houses in each section using the same kind of brush have been brought together. In the upper valley the decay from brushing the fruit was 4.9 per cent and in the coast region 4.3 per cent, or practically the same result. The packing-house tests indicate that an orange with a sound skin is not more likely to decay when grown in the coast region than a similar orange grown in other parts of the orange belt and that a similar line of handling produces similar results in the different regions.

The difference that occurs in the amount of decay in different regions or in different houses in the same region is due primarily to the conditions under which the fruit is handled. In the coast region in the past a large part of the fruit has had to be washed, while the fruit of the upper-valley districts has been shipped in a dry-brushed or unbrushed condition. Since these investigations were begun, the representatives of the Bureau of Plant Industry have had occasion to look into the conditions in many sections where the fruit developed unusually large amounts of decay. In every case the cause of the trouble has been found to be due to the conditions under which the fruit has been handled, including the influence of such matters as the care with which the scale insects are held in control in the groves, the business capacity of the directors of the association, the ability of the packing-house foreman, the system of handling labor in the groves and packing houses, the efficiency of the labor, the sanitary conditions in the packing houses, and the kind of packing-house equipment. Wherever these conditions have been bad a section has acquired the reputation of producing fruit that has poor shipping quality, and wherever these conditions have been favorable to the proper handling of the fruit there has been no trouble with its condition on arrival at destination.

By these remarks it is not intended to convey the impression that the fruit of all sections is alike. There is the widest difference in the quality, in the time of maturity, and in the color of oranges of different sections and in different groves in the same section. There is probably a good deal of difference in the susceptibility of the fruit of different regions to bruising, as there is a wide difference in the texture of the fruit. What is intended to be conveyed is that there is no practical difference in the amount of decay that develops even in the tenderest oranges of a section when the fruit is handled with enough care to prevent bruising.

THE DECAY IN ORANGES IN DIFFERENT PERIODS OF THE SEASON.

To determine the influence on decay of picking the oranges at different times during the season 20 boxes of the Washington Navel were carefully picked about every ten days from January to May from a grove of the Arlington Heights Fruit Company, Riverside, Cal. The fruit was held two weeks under conditions that were especially favorable to the development of rot. The decay in the fruit picked at different times is brought out in the chart shown as figure 9.

There was practically no difference in the amount of decay in the fruit at any time between January and May. The small amount of decay could usually be traced to mechanical injuries that were overlooked when the fruit was brought in from the groves, and the slight difference in the amount of decay at the different pickings could be easily accounted for in this way. The trees were in bloom when the fruit was picked on March 23 and April 2.

The data from these tests are not extensive enough to be conclusive, but taken in connection with the other data accumulated they indicate that California oranges picked and handled with enough care to protect the skin from bruising are practically immune to decay, whether picked in a partially ripe or fully matured condition. In this connection the series of shipments of carefully handled fruit from February to May under ventilation, referred to on page 44, does not show an increase in decay as the season advanced.

It is popularly believed that the fruit is more susceptible to decay at the period just preceding and during the blooming of the trees. This belief does not appear to be well founded. The increase in decay that sometimes occurs in the shipments in February or March is probably related to rises in temperature in California at that time, causing the fruit to be loaded in a hot condition. There is often a period of hot weather for a few days each year at this time. The fruit is still being shipped under ventilation. The oranges that go forward at that time from the sections that handle the fruit roughly develop excessive amounts of decay. This may be followed by cooler weather or by the adoption of icing in place of ventilation, and the decay falls off. Whenever the weather remains cool throughout the shipping season there appears to be no unusual increase in the amount of rot at the blooming time.

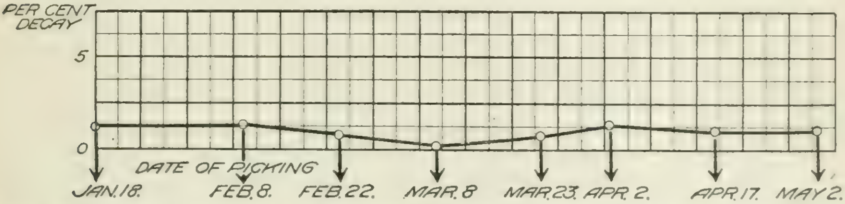

FIG. 9.—Diagram illustrating the percentage of decay in oranges picked at different times during the harvesting season, 1906.

An increase in decay usually follows an overcrowded condition of the packing houses or a temporary shortage in the supply of cars in warm weather. It may also be serious at the height of the harvesting season. Under the first condition the fruit is handled with less than the usual care and is made more susceptible to rot. Under the second the decay begins to grow in the bruised fruit while the oranges are standing in the packing house. Under the third condition the grower has to employ a large amount of unskilled labor, as there is not enough skilled labor to harvest the crop at the height of the season, and the fruit is delivered to the packing house in poor physical condition.

In the commercial shipments the decay is usually worse in April and May than it is earlier in the season, largely because the average temperature is higher, causing the decay to start quickly, and also because it develops more readily in ripe bruised oranges than in fruit that is bruised but immature.

THE CURING OF ORANGES BEFORE PACKING.

At the time the investigation described in this bulletin was begun, it was a common practice to hold oranges in a packing house a few days before packing. This practice was referred to as "curing." It consisted in the wilting or the evaporation of a small amount of moisture from the skin of the orange, thereby making it more pliable and easier to pack. It was considered necessary to wilt the fruit in order that it might be pressed into place in the packing box without injury and to insure the arrival of the package in market in a tight condition. It was believed that by packing hard, freshly picked fruit the curing or wilting would occur in the box, and the pack would arrive at destination in slack condition. A final claim for curing was that much, if not all, of the decay resulting from mechanical injuries would be sufficiently developed to be noticed and discarded by the graders or packers by holding the fruit in the house a few days before packing.

The general claims for curing have not been found to be well established. Early in the shipping season, when the oranges are immature and the skin hard, wilting or curing undoubtedly facilitates the packing of fruit. Later in the season, when the fruit is ripe, the curing does not appear to improve this condition, as the fruit is naturally pliable. The arrival of oranges in a slack condition in the box is not due primarily to packing uncured fruit. It is the result of packing the fruit loosely and poorly in the box. If each orange is pressed firmly into place by the packer, the fruit can be shipped at any time of year as soon as it is picked, and the packages will arrive in full, firm condition. The average packer does not take time to press each orange firmly in place, especially if the packing is paid for by the box. The packages are filled high and the cover press is expected to do the work that should have been done by the packer. The press, however, only makes the upper layers of the fruit tight in a loosely packed box. The fruit settles during the trip and arrives in a loose condition. These remarks are based on the fact that many of the leading shippers have packed the fruit within twenty-four hours after picking during the last two years without complaint as to the condition of the pack on arrival.

It is not true, either, that the decay develops in the mechanically injured oranges during the curing period except in warm weather and in fruit that is most seriously injured. The decay may start to grow during this time, but it requires several days for it to progress far enough to soften the fruit and to be seen by a grader. The decay is less severe in the unpacked boxes than it is in the packed fruit, in which the moisture given off by transpiration is retained. If fruit can not be shipped quickly after picking it is better to leave it in an unpacked condition.

The curing of the orange does not appear to be detrimental to the shipping quality of sound fruit at any season, or to slightly injured fruit in cool weather. Early in the season it makes the fruit somewhat easier to handle by the packer, but under the conditions pertaining to the commercial handling of the fruit in California it probably does more harm than good by allowing the decay to begin to grow in the mechanically injured fruit. If this fruit soon after picking is shipped under refrigeration or enters cool territory soon after picking, the decay may not start to grow.

THE BRUSHING OF CALIFORNIA ORANGES.

The practice of brushing oranges grew up gradually in California. Practically all of the fruit was being either brushed or washed when the present investigation was begun. The fruit was brushed originally to remove the light coats of sooty-mold fungus or the dust that accumulates from the tillage of the groves in the dry season. The fruit was given a glossy appearance by the brushing similar to the artificial glossiness that is characteristic of the polished fruit sold from street stands. The shipper and the receiver finally considered it necessary to brush the fruit whether it was dirty or not, and brushing became established as a regular packing-house operation even in houses to which the fruit is delivered from the groves in a clean condition.

Several types of brushes have been developed in California. A kind commonly used is shown in Plate IV, figure 1. Some brush the fruit lightly, while the stiff fiber brushes or those not adjustable to fruit of different sizes may brush the oranges very harshly. In the packing-house experiments, the decay has often been raised from 10 to 40 per cent in small lots of fruit run through a brush of a harsh type or through a brush that was improperly adjusted. The injury from the brush generally arises from the inoculation of the mechanically injured parts of the skin with blue-mold spores that are attached to the bristles of the brush or by the actual puncturing of the skin by the bristles and inoculation at the same time in the case of the harsh types or badly adjusted brushes. It is probable that light brushing is not injurious to sound oranges.

There is a wide difference in the quantity of dust and sooty mold on the fruit of different groves and in different seasons. All of the groves are comparatively free from dust during the rainy season, from January to April or May, and in groves that are well fumigated, and in most of those in the upper part of the San Bernardino Valley the fruit is practically free from the sooty-mold fungus.

It improves the appearance of an orange to have the dirt removed from the skin. It detracts from a moderately clean orange to have the natural bloom replaced by a gloss, and this altered appearance does not improve the selling value of the fruit. It is wholly unnecessary to brush a large part of the California crop, though it may be advisable to brush the fruit that grows on the rows along the highways, or to brush the entire crop after the rainy season is ended and the dust from the tillage of the land settles on the fruit. In Plate IV, figure 2, an arrangement is shown with a removable carrying belt placed on the box containing the brush. This belt carries the fruit from the hopper over the brush to the elevator leading to the sorting table. When a load of fruit requires it the belt is removed and the oranges are run through the brushes.

In 1906 the brushes were eliminated from two or three packing houses, and in 1907 at least a dozen houses, including those that shipped the brands which brought the highest prices throughout the season, forwarded the fruit without brushing.

THE WASHING OF CALIFORNIA ORANGES.

Oranges are washed primarily to remove the sooty-mold fungus that grows in the so-called honeydew exuded by the black scale (*Saissetia oleae* Bern.). The Valencia orange is sometimes washed to raise the grade by making the fruit clean and attractive, and the Washington Naval is occasionally washed with that end in view.

When the present investigation by the Bureau of Plant Industry was undertaken, from one-third to one-half of the oranges of California were washed, practically all of the fruit in some sections being treated in this way, especially where the growers had been overconfident in the parasite *Scutellista cyanea* Matsch or in the use of oil sprays as means of holding the black scale in check.

The honeydew from the black scale spreads out over the branches, leaves, and fruit, and in severe infestations the fungus which grows upon it makes the oranges black and unsightly. The fungus forms a thin skin-like covering over the orange which is removed by washing, or in light attacks by brushing the fruit. A Valencia orange affected with sooty-mold fungus and one free from the trouble are shown in Plate VIII.

The injury arising from washing the orange is primarily due to the water of the tank becoming infested with spores of the blue mold. These spores are carried into the mechanical abrasions of the skin by the water, under conditions that favor the growth of the fungus. The decay in washed fruit is also increased from the fact that the fruit is handled through a complicated system of tanks, brushes, elevators, racks, and other machinery which multiplies the chances of mechanical injury. A good deal of the fruit is packed before it is thoroughly dry, thereby making conditions of moisture favorable for the development of decay in the packed fruit. This condition arises during cloudy weather when there is not sufficient sunshine to perfect the drying and at times when the fruit is not delivered to the packing house fast enough to keep the packers supplied with dry fruit.

The water is always more or less infected with the spores of the rot fungus. They are found abundantly on the skin of sound oranges and in the dirt from the bottom of the boxes; in practice, also, decaying oranges frequently pass into the tank. This condition becomes aggravated when the water is not changed frequently. It is least objectionable when fresh water is constantly running through the tank or when the oranges are run through brushes with the water sprayed over them. In the average house the water in the tanks was not changed oftener than once in every day or two until 1907, when in many of the houses the water was kept running constantly through the tanks. It apparently is not injurious to the orange to wash it in clean water, provided it is handled carefully in other respects.

The necessity for washing the fruit should be avoided.—The necessity for washing the orange should be avoided by a proper fumigation of the groves with cyanide of potassium or by spraying, if it can be effectively done, rather than by treating the fruit in the packing house. It has often been suggested that the blue mold might be killed by a disinfectant in the wash water, as is done with the parasitic fungus of the lemon which produces the brown rot. This does not appear from preliminary studies to be promising or advisable. If it were possible to kill the blue mold in the washing tank, it would place a premium on the shiftless management of the groves and on the rough, careless handling of the fruit. Fumigation, on the other hand, is one of the operations that promotes good orchard management; it maintains strong, healthy trees and fruit, and it reduces the cost of preparing the oranges for market in a manner that increases the keeping quality of the fruit.

PACKING-HOUSE EQUIPMENT AND CONDITIONS.

The equipment of the average packing house, especially before 1907, was too complicated to permit of careful handling of the fruit. Some part or parts of the equipment were usually out of order, and there were additional chances for injury from the falling or rapid running of the oranges over gravity chutes or runs. Many of the packing houses have not been equipped on good mechanical principles or with proper regard for the effect of the handling of the fruit on its keeping quality. It is not too much to say that there was practically no consideration given to the effect of packing-house machinery and its installation on the carrying quality of the fruit from about 1895 to 1906, the development being made primarily to handle large quantities at low cost. Since 1906 a good many houses have been modified by the installation of a simpler type of machinery. A better idea of the former condition of many packing houses and of some houses at the present time may be had by referring to a typical example of improper equipment.

A prominent house that had the reputation of shipping fruit of poor keeping quality was running the oranges through about a thousand feet of machinery of different kinds. In order to force the fruit through the machinery as rapidly as possible, a boy shoved the oranges into the washing machine with a paddle, the fruit clogging in the machine frequently and becoming crushed. As many as 1,200 boxes were sometimes run through the washer in ten hours. The capacity of the elevator leading from the washer to the drying racks was overtaxed, and the oranges were dropping back into the washer from heights varying from one to several feet. The fruit was frequently shoved down the drying racks with poles, and in practically every rack the oranges were bumping over the heads of nails or slivers of wood protruding into the runways. It was a common thing to see a boy kick the oranges into place when the bins became clogged. In this packing house eleven different places were located where the fruit dropped from 1 to 2½ feet or where the oranges were delivered with force at the bottom of a long gravity chute. As a result, crushed and broken oranges could be found at any time along the runways through which the fruit was obliged to pass. It is a tribute to the shipping quality of the California orange that so large a proportion of the fruit of this house arrived in market in sound condition after this harsh type of handling.

Features to be avoided in a packing house.—It is difficult to point out a single place where fruit is likely to be injured in different packing houses, as the arrangement of the machinery varies widely. There are a few features in the arrangement of every packing house that ought to be considered. A house should be equipped in the simplest possible manner in order to avoid handling the fruit more than is necessary. The dropping of the fruit or its swift delivery from the carrying belts should be avoided. Overhead sizers and all gravity chutes are to be condemned. The slow-moving, flat carrying belts should take the place of the gravity chute, as in this way the fruit may be carried wherever desired without injury. The gravity sorting table ought to be replaced by a low belt sorting table.

The hopper is a source of much injury from the rough dumping of the fruit from the picking boxes. A hopper ought not to be higher than the brush to which it leads, and the fruit may be carried to the brush by belts extending into the hopper instead of by a steep gravity run. The present hoppers are too high to make the emptying of the boxes easy. The hopper ought to be well padded.

It is a question worth considering whether the hopper can not be eliminated from many houses and the fruit delivered to the sorting belts or on a carrying belt leading to the sorting table. It is entirely practical, if necessary, to deliver the fruit on these belts by taking the oranges out of the boxes by hand.

There is also much injury to the oranges in dropping into and in delivering from the weighing machines and in the drop of the fruit into the packing bins of various kinds, none of which prevents a considerable fall of the fruit when it enters the bin. Another source of injury is the rapid delivery of the fruit from a carrying belt to the elevators, scales, bins, or other part of the machinery to which the belts lead. This defect is the result of the use of narrow belts which have to be run at high speed to meet the requirements of the house rather than the use of wider belts of larger carrying capacity.

There has been a great improvement in packing-house equipment in the last two or three years, but the opportunity for the development of simpler types of houses and equipment has not yet been exhausted.

The handling of the packing-house force and equipment is also an important factor. Unless the packing-house manager is adapted to the handling of labor and can keep the machinery in smooth running order, no amount of improvement in the machinery of the packing house can overcome the bad effect on the fruit of careless, rough, undisciplined labor.

In addition to the need of a simple equipped and well-managed house, the most rigid attention needs to be given to the removal of decaying fruit from the house and its surroundings. It is not uncommon to see rotting oranges in the bins, on the floor, and on the ground around the house. Under these conditions, the houses are filled with myriads of blue-mold spores. This lack of attention to the cleanliness of a packing house has a bad effect on the labor, and it is invariably accompanied by rough handling and slovenly work in general. On the other hand, there is not a packing house in California that is leading in the careful handling of its fruit that does not use rigid care to keep the house and its surroundings clean and sanitary.

THE DECAY OF ORANGES IN TRANSIT.

GENERAL DESCRIPTION OF THE EXPERIMENTS.

The investigation of the decay of oranges during transportation included 40 shipments in 1905, 70 shipments in 1906, and 187 shipments in 1907. Nearly all of the fruit was forwarded to New York. The leading object of this investigation was to determine the relation of the following factors to the development of decay in transit: (1) Preparing the orange for shipment in different ways in California; (2) forwarding it at different lengths of time after packing, and (3) shipping the fruit under different systems of transportation. An investigation has also been made of the changes that occur in the temperature in refrigerator cars when handled under different conditions during the transcontinental trip, and a number of technical engineering problems connected with refrigeration have received consideration. The shipments have included duplicate lots of apparently sound brushed or unbrushed fruit, of sound washed fruit, of the regular commercially packed fruit, and of oranges showing visible mechanical injuries, such as stem punctures, clipper cuts, and other types of abrasions. The different lots have been packed from the bins from which the commercially packed fruit was taken by careful sorting by representatives of the Bureau of Plant Industry. Duplicate lots of fruit have been forwarded as soon as packed and on the second and the fourth days after packing under (1) ventilation, (2) icing, and (3) precooling followed by icing. The decay has been determined by Bureau representatives by the inspection of every orange on the arrival of the fruit in New York.

Through the cooperation of the shippers and receivers, the fruit for these shipments has been turned over to the Bureau of Plant Industry for experimental use and after inspection in New York has been returned to the receiver. The railroad companies have extended every facility for the study of the conditions in transit, and the cold-storage interests of southern California made it possible to carry on technical as well as commercial investigations of the precooling process.

The result of the shipments of each of the three years has been consistent with the others. It is impossible to record the details of each shipment during the three years. The shipments of 1907, which were on the most comprehensive scale and are most representative of commercial conditions, will be discussed as representative of the entire work.

THE SHIPMENTS UNDER VENTILATION.

The shipments under ventilation began in 1907 in February and extended into May. During February and March the weather was cold in California as well as during the trip across the continent. The temperature of the fruit was not often above 50° F. when loaded, and was frequently as cold as the precooled fruit. On the average, the fruit was probably cooler during the entire trip than the oranges shipped under ordinary icing later in the season. The average decay in the shipments under ventilation, therefore, was comparatively low.

There were two series of shipments under ventilation. The first included apparently sound brushed and washed fruit, commercially packed fruit, and mechanically injured fruit. One-third of each lot went forward as soon as packed and the remainder on the second and the fourth days after packing. This fruit was taken from sections in which the fruit is handled with average commercial care, not representing the roughest type or the most careful type of handling. The fruit was shipped in February. The second series was taken from a single house in which the fruit is handled with care in the groves and in the packing house. It represents the regular commercial pack of the house, the fruit showing on the average not more than 1 to 3 per cent of mechanical injury. The fruit of this house is not brushed. The shipments in the second series began in February and extended into May. The result of the shipments under the first series, shown also in figure 10, is brought out in the following table:

TABLE III.—*Percentage of decay in oranges handled with average care, shipped under ventilation, February, 1907.*

Treatment or condition of fruit.	Decay following immediate shipment and approximate delay of 2 days and 4 days.			
	(None.)	(2 days.)	(4 days.)	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brushed fruit, apparently sound	1.4	2.2	2.7	2.1
Washed fruit, apparently sound	1.7	3.7	5.1	3.5
Commercially packed fruit	2.1	4.8	5.3	4.1
Mechanically injured fruit	9.4	15.0	21.7	15.4
Average	3.6	6.4	8.7	....

Two important factors are brought out by these shipments: (1) The oranges that are handled the most simply, i. e., the apparently sound brushed fruit, develop the least decay, while the fruit that is sorted from the same bins but has been injured in handling develops the greatest amount of decay; (2) the fruit, taken as a whole, that was shipped out promptly after packing developed little decay, while the fruit that was delayed before shipment developed a good deal of decay, the injury from the delay being least severe in the sound brushed fruit and greatest in the fruit that was mechanically injured. The increase in the decay in the apparently sound brushed and washed fruit as a result of the delay in shipping is probably due to the fact that it was not possible to eliminate all of the injured oranges in sorting the fruit from the bins.

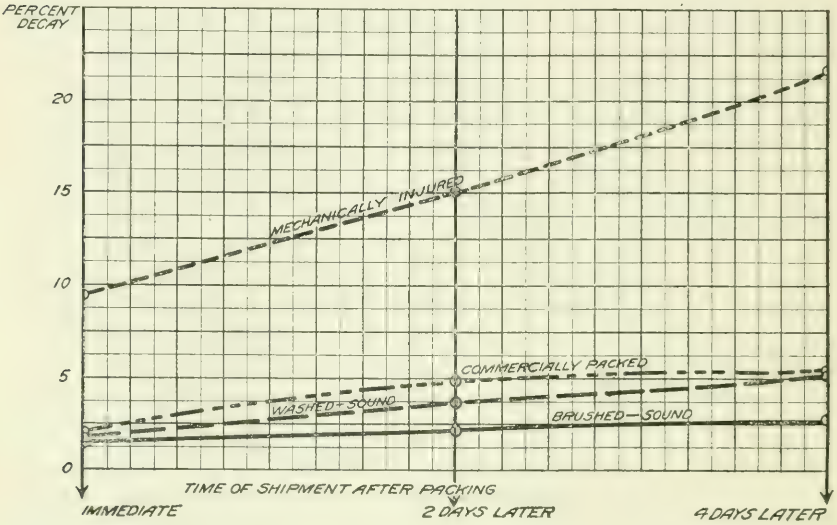

FIG. 10.—Diagram illustrating the percentage of decay in oranges handled with average care, shipped under ventilation, February, 1907.

The result of the shipments under the second series, i. e., of fruit handled carefully in the groves and packing houses, is brought out in the following table:

TABLE IV.—*Percentage of decay in oranges handled carefully under commercial conditions and shipped under ventilation from February to May, 1907.*

Date of first shipment.	Decay following immediate shipment and approximate delay of 2 days and 4 days.			
	(None.)	(2 days.)	(4 days.)	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
February 26	0.7	0.8	1.3	0.9
March 19	1.8	1.7	1.8	1.8
April 1	1.0	1.9	2.3	1.7
April 19	0.8	1.4	2.7	1.6
May 1	2.7	1.7	2.7	2.4
Average	1.4	1.5	1.9	....

This table shows that oranges can be handled in a large commercial business with enough care to insure the arrival of the fruit in market in sound condition when shipped under ventilation through a large part of the Washington Navel shipping season. It also shows that there is little practical difference in decay in sound fruit shipped in February or in the succeeding months. As the fruit of this house has shown no better inherent keeping quality than other sound fruit from the same region, a brief description of the methods employed in handling the crop will be useful in showing how a crop is carefully handled in a large commercial business.

Methods used in preventing decay in oranges in a large commercial business.—The fruit shipped under the last series was grown and packed by a corporation owning several hundred acres of groves and packing its own fruit. When the present investigation of the Bureau of Plant Industry was undertaken in 1905, the fruit from this house sometimes arrived in market showing from 5 to 30 per cent of decay. The handling of the fruit was done with the average care used in preparing the fruit for market at that time. An investigation showed that 20 to 25 per cent of the oranges were cut with the clippers or were stem punctured, and that the packing house, which was equipped with overhead sizers, contributed to the further injury of the fruit. In 1906 and in 1907 the fruit was picked with care. The labor in the groves is paid by the day. It is under the management of a competent foreman. As a rule the orange as cut from the tree has a long stem, and a second cut removes the stem close to the fruit. The pickers average from 40 to 50 boxes a day, and the clipper cutting and stem puncturing have been reduced to from 1 to 3 per cent. The loading and the hauling of the boxes to the packing house are done with care. Gravel is kept out of the boxes and they are not filled full enough to bruise the oranges on the top when the boxes are stacked. The packing house is handled by a skillful foreman. The oranges are not brushed. The machinery is of the simplest kind and is run at comparatively low speed. The packing and the loading of the cars are done with care. The packers average from 50 to 60 boxes a day. The fruit has been shipped under ventilation until about two months after most of the shipments from southern California have begun to be forwarded under ice.

From the business standpoint this fruit took high rank in the market as soon as careful handling methods were adopted in 1906, and it has held it ever since. In addition to a good pack, it has commanded the confidence of buyers on account of arriving in sound condition day after day. The excess in net return has been many times greater than the extra cost of careful handling. The extra cost of handling the fruit carefully has probably not amounted to 10 cents a box.

What has been accomplished here can be duplicated, so far as the sound arrival of the fruit is concerned, by any other shipper in California who will preserve the natural keeping quality of the fruit by handling it carefully in the grove and packing house rather than attempting to handle the shipments at the lowest possible cost under conditions that make the fruit susceptible to decay.

THE SHIPMENTS UNDER ICE.

The shipments under ice in 1907 began in March and extended to the last of May. They were made from different parts of the citrus belt. There were two series of shipments under ice. The first was from a group of houses in which the fruit was handled in the groves and packing houses rather roughly. It included apparently sound brushed and washed fruit, commercially packed fruit, and mechanically injured fruit. The second series was from a group of houses in which the fruit was handled in the groves and packing houses with more than average care. It included apparently sound brushed fruit, commercially packed fruit, and mechanically injured fruit.

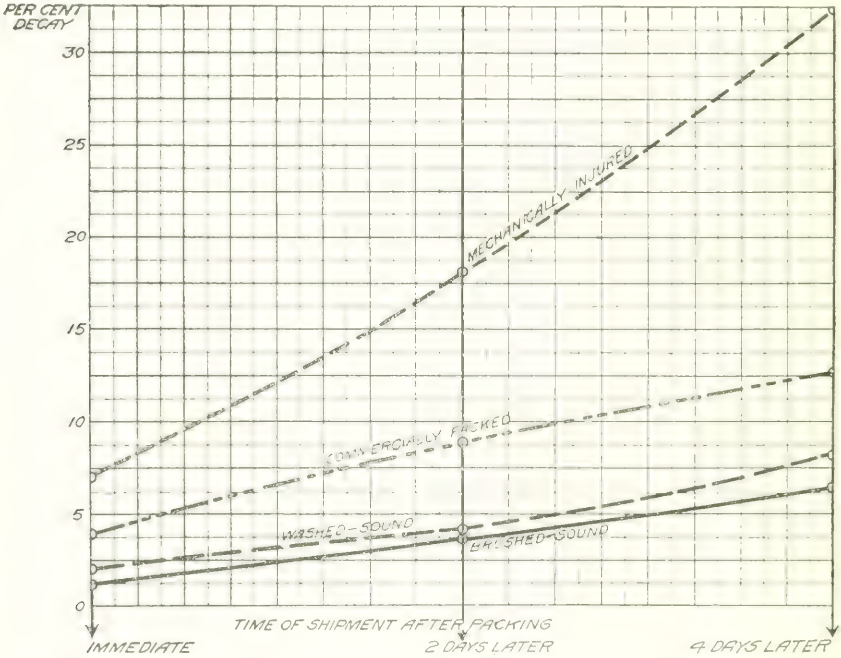

FIG. 11.—Diagram illustrating the percentage of decay in oranges handled rather roughly, shipped under ice, February to April, 1907.

The result of the shipments under the first series, shown also in figure 11, is brought out in Table V:

TABLE V.—*Percentage of decay in oranges handled rather roughly and shipped under ice, February to April, 1907.*

Treatment or condition of fruit.	Decay following immediate shipment and approximate delay of 2 days and 4 days.			
	(None.)	(2 days.)	(4 days.)	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brushed fruit, apparently sound	1.2	3.7	6.4	3.8
Washed fruit, apparently sound	2.0	4.2	8.1	4.8
Commercially packed fruit	3.9	8.9	12.6	8.5
Mechanically injured fruit	7.0	18.1	32.4	19.2
Average	3.5	8.7	14.9	....

Two important factors similar to those developed in the shipments under ventilation are brought out by these shipments: (1) The decay is least in the fruit that is handled the least, i. e., the apparently sound brushed fruit, and greatest in the fruit that is mechanically injured; (2) the decay increases as the time between packing and shipping increases. The delay in shipping the fruit causes the least injury to the soundest fruit and develops the greatest injury in the mechanically injured oranges.

The result of the shipments from the houses in which the fruit was handled with care is brought out in the following table:

TABLE VI.—*Percentage of decay in oranges handled carefully and shipped under ice, March to May, 1907.*

Treatment or condition of fruit.	Decay following immediate shipment and approximate delay of 2 days and 4 days.			
	(None.)	(2 days.)	(4 days.)	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brushed fruit, apparently sound	1.0	1.8	2.6	1.8
Commercially packed fruit	1.0	2.6	4.6	2.7
Mechanically injured fruit	7.9	9.0	14.7	10.5
Average	3.3	4.5	7.3	....

As in the other series under ice, the least decay developed in the sound brushed fruit and the greatest amount occurred in the mechanically injured oranges. The decay is proportional to the length of time that elapses between packing and shipping. The decay in all of the shipments in the second series is less than that in the fruit that was handled more roughly, on account of the sounder condition of the fruit.

A practical illustration of careful handling methods.—There are included in the last series shipments from a grower with extensive groves, whose fruit early in the season of 1907 arrived in New York in bad condition. Some of the carloads developed as much as 25 per cent of decay. Both the shipper and the receiver thought the decay was due to excessive tenderness of the fruit brought on by over-fertilizing or to other methods followed in handling the groves. An investigation of this case showed that about 20 per cent of the fruit was mechanically injured in handling. The pickers were paid by the box. It was not considered essential to ship the fruit as soon as it was picked. The packing-house machinery was not well adapted to the careful handling of the fruit, and in the packing house the labor was done with no great care.

The grower decided to change his method of handling the crop. Two or three foremen were tried in the groves before a satisfactory man was found to handle the picking gang; the labor was paid by the day, the picking was done with care, clipper cutting and other injuries were reduced to an average of about 5 per cent, the packing-house equipment was remodeled and simplified, the fruit was not brushed, and it was delivered by hand from the picking boxes to a wide belt that led to the sorting table. The packing-house operations were conducted with more care than formerly. The result of these changes is one of the most striking that has come under the observation of the representatives of the Bureau of Plant Industry.

The decay in the commercial shipments disappeared as soon as the old methods were changed and did not reappear throughout the season. From the business standpoint the brands from this grower, which up to this time had been handled with caution by the New York buyers, commanded confidence and sold at prices not often surpassed by other brands of fruit. The fruit from this house handled in the experimental shipments developed the following average decay: Apparently sound unbrushed fruit, 1.2 per cent; commercially packed fruit from the same bins, 4.1 per cent; mechanically injured fruit from the same bins, 14 per cent. This grower has recently stated that by insisting rigidly on the careful handling of the oranges the net increased receipts averaged from 50 cents to $1.50 a box after the change in methods was adopted.

An illustration of better handling methods.—There were also included in the shipments under ice oranges from an association that in 1905 had the reputation of producing fruit of the poorest carrying quality, though excellent in other respects. An inquiry in several markets showed that the receivers always expected excessive decay in the brands of this fruit. Many of the growers believed that the decay was due to mysterious local climatic and soil conditions. An investigation of the case in 1906 showed that the growers had depended on the *Scutellista cyanea* Matsch to hold the black scale in check and little fumigation or spraying had been done in the section for three or four years. The groves were badly infested with scale. Probably 90 per cent of the fruit had to be washed. The packing-house management exercised little control over the picking of the fruit. On the whole, it was carelessly picked, much of it showing from 25 to 30 per cent of injury. The handling of the fruit in other respects was done with average care. The packing house was of the type shown in Plate III, figure 2. The fruit that was washed passed through more than a thousand feet of machinery of different kinds before it was packed. The fruit often remained in the house a week or more before it was shipped.

As the conditions in this association were typical of many others, both packing-house experiments and shipping experiments were carried on during 1906 and 1907. In 1906 the fruit in the packing-house experiments developed the following amount of decay: Apparently sound unbrushed fruit, 1.9 per cent; apparently sound dry-brushed fruit, 4.2 per cent; apparently sound fruit run through the washers and all other machinery, 10 per cent; mechanically injured fruit, 23 per cent.

The growers were convinced from these experiments that the fruit was not inherently poor in keeping quality. There was a general fumigation of the groves in the section in the autumn of 1906, and not more than 50 per cent of the fruit was washed in 1907. The overhead machinery was eliminated, the equipment considerably simplified and changed, the picking was done with more care in 1907, part of it by a picking crew under the control of the packing house, and the fruit was shipped out more quickly whenever the car shortage did not delay the shipments. In 1907 the average decay in the shipping experiments was as follows: Apparently sound brushed fruit, 1.8 per cent; apparently sound washed fruit, 2.6 per cent; commercially packed fruit, 4.8 per cent; mechanically injured fruit, 26.9 per cent.

This association has not yet reached the limit of practical improvement, but the reputation of its brands of fruit has already been elevated to a higher class, as the fruit has continued to arrive in the markets in better condition than formerly.

THE SHIPMENTS OF PRECOOLED FRUIT.

The shipments of precooled oranges in 1907 were begun in March and extended into May. They included apparently sound brushed and washed fruit, commercially packed fruit, and mechanically injured fruit, placed in cold storage at different lengths of time after packing and allowed to remain there until the fruit reached a temperature of 35° to 40° F., when it was shipped in refrigerator cars cooled by icing before the oranges were loaded.

The result of the shipments from a group of houses in which the fruit is handled roughly in the groves and packing houses is shown in the table following and also in figure 12:

TABLE VII.—*Percentage of decay in precooled oranges, March to May, 1907.*

Treatment or condition of fruit.	Decay following immediate cooling after packing and a delay of 2 days and 4 days.			
	(None.)	(2 days.)	(4 days.)	Average.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Brushed fruit, apparently sound	0.1	2.3	3.4	1.9
Washed fruit, apparently sound	0.8	2.3	5.5	2.9
Commercially packed fruit	2.2	6.2	9.1	5.8
Mechanically injured fruit	3.0	9.2	13.9	8.7
Average	1.5	5.0	8.0	....

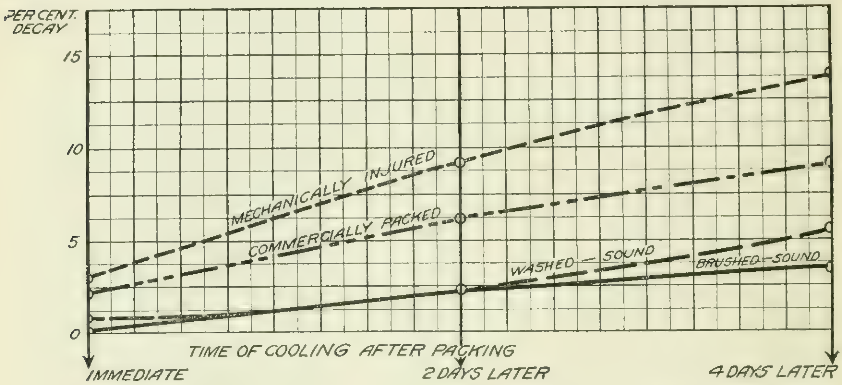

FIG. 12.—Diagram illustrating the percentage of decay in oranges cooled before shipping, March to May, 1907.

It will be seen from the table and from figure 12 that the apparently sound brushed fruit decayed least and that there was a progressive increase in the decay through the washed, the commercially packed, and the mechanically injured fruit. This increase in respect to the different types of fruit is similar to that occurring in the shipments under both ventilation and ice. The precooled shipments also bear out the principle of the shipments under ventilation and ice in that the least decay developed in the oranges that were cooled quickly after packing, and considerable decay developed in the fruit in which there was a delay in cooling after it was packed. It appears to be as essential to cool the fruit quickly if it is to be cooled before shipment as it is to ship it promptly after packing, under ventilation or ice. If the decay has an opportunity to develop for several days after the fruit is packed, it can not be eliminated by cooling the fruit to a lower temperature later on.

A COMPARISON OF THE DECAY FOUND IN CONNECTION WITH THE DIFFERENT METHODS OF SHIPMENT.

By comparing the data under the different methods of shipment it will be seen that the apparently sound brushed fruit arrived under all conditions of shipment with the least decay; that the apparently sound washed fruit, which is more susceptible to decay on account of the washing and additional handling to which it is subjected, decayed more; that the commercially packed fruit, which contains more or less injured fruit, decayed still more, and that the greatest amount of decay developed in the mechanically injured fruit. Sound fruit to start with, therefore, is the foundation for sound fruit in market under all methods of shipment.

It is equally clear that it is essential to ship the fruit promptly after packing or to cool it quickly if it is to be cooled before shipment. A delay of two days in shipping under ventilation or ice or in the cooling of the fruit resulted in an increase in decay, while a delay of four days developed a still greater amount, the increase being least in the apparently sound dry-brushed fruit and greatest in the mechanically injured fruit. It is better to leave the fruit on the trees until it can be shipped than to pick it and leave it in the packing house several days before shipment unless the weather is cold enough to retard the development of decay.

As to the amount of decay under the different methods of shipment, the least decay developed in the precooled fruit, provided the shipments from the houses that handle the fruit roughly, as shown in figures 10, 11, and 12, are compared. On the other hand, there was less decay in the carefully handled commercial shipments under ventilation, discussed on page 44, than in any other series, notwithstanding the fact that the shipments extended through a greater length of time than those that were iced or precooled. This was due to the sounder condition of this fruit as a result of the careful handling methods used in its preparation for market. It will be seen also that the decay in the fruit shipped under ice from the group of houses that handle oranges carefully, discussed on page 47, is less than the decay in the roughly handled fruit cooled before shipment, discussed on page 46 and shown in figure 11.

The comparative data bring out clearly that if the fruit is uninjured when it leaves California it is likely to arrive in the East in comparatively sound condition, and that under adverse conditions, such as a delay in shipping the fruit, there is less decay in apparently sound fruit than in oranges that have been injured by handling. These data show clearly that it is detrimental to the shipping quality to delay the shipment of the fruit after it is picked and packed, and, finally, that fruit which is susceptible to decay develops the least trouble when shipped under the precooling method.

THE OBJECT OF COOLING FRUIT BEFORE SHIPMENT.

The principal object of cooling fruit before shipment is to quickly retard the ripening processes and the development of decay and to equalize the temperature in the car during the trip. In ordinary iced shipments the fruit is loaded in a car in a warm condition. It requires several days after the fruit is loaded before the temperature of the fruit is reduced to a degree of cold that retards the ripening and the decay. The ripening springs forward with unusual rapidity as soon as a fruit is picked, and as the air of the car is moist from the transpiration of the fruit the conditions are favorable to the rapid development of decay. In a refrigerator car the fruit is cooled by a slow gravity circulation of air from the ice bunkers. The temperature of the air as it leaves the bunkers may fall as low as 34° F. It is warmed by contact with the fruit and grows warmer as it ascends and reenters the ice bunkers of the car. The temperature in the top of the car is several degrees warmer than in the bottom during the first part of the trip, as shown in figure 20, but this difference gradually grows less as the fruit becomes cold.

These are fundamental difficulties in the present methods of handling perishable fruits. They limit the distribution of fruit to the area over which the top tiers of packages can be safely shipped, thereby preventing the development of the most distant domestic and foreign markets. They make it necessary to harvest the summer fruits prematurely to provide against the ripening that takes place in transit, thereby placing large quantities of insipid, flavorless peaches, plums, and other fruits before the consumers.

THE REFRIGERATION OF CITRUS FRUITS IN TRANSIT.

All of the considerations previously mentioned do not apply to the shipment of oranges under the ordinary methods of refrigeration. The ripening processes in citrus fruits proceed so slowly and are of such a nature that it is not necessary to ice the cars to retard the ripening even with ripe fruit in hot weather. The citrus fruits are iced primarily to retard the development of decay and secondarily to retain the fresh appearance of the fruit on arrival in market by preventing undue evaporation from the skin during the trip. A carload of oranges under refrigeration cools down slowly, as each orange is partly insulated in the paper wrapper. The loose ends of the wrappers make a layer of paper between the rows of oranges, and the fruit is packed so firmly that this prevents a free circulation of cold air around each orange. The cooling is done by conduction of heat from orange to orange and to the air surrounding the packages. In warm weather a car of fruit often covers from one-fourth to one-third of the trip across the continent before the temperature of the oranges drops to 50° F., as shown in figures 18 and 19. The fruit, therefore, may decay during the first part of the trip if it has been handled in such a way as to make it susceptible to decay, especially if it is not shipped promptly after picking and packing. If it is shipped promptly it does not decay excessively except in hot weather, as will be seen by reference to figure 11. The icing of the fruit retards the development of decay temporarily. It transfers the decay from the shipper to the receiver. It does not affect the shipping quality, except the general appearance, or the keeping quality of sound oranges, but it is a means of overcoming for the time being the bad effect of handling the fruit improperly in the groves and packing houses.

THE COOLING OF ORANGES BEFORE TRANSPORTATION.

The cooling of the orange before shipment insures less decay in transit in poorly handled fruit, as the fruit is started in a cold rather than a warm condition. The fruit arrives in sounder condition, but the oranges that might have decayed in transit under ventilation or ordinary icing decay after the fruit is removed to a warm temperature unless it passes quickly into consumption, as shown in figures 14 and 15. Icing or precooling used primarily to overcome the effect of improper methods of handling in the groves and packing houses should be severely condemned, as it is a means of deceiving the purchaser who buys fruit that is apparently sound only to find the decay developing as soon as the fruit is removed to a warm temperature.

The use of icing or of precooling as a means of overcoming losses that the grower and shipper can not prevent in the ordinary course of business is commendable and is essential in the handling of most of the orange crop in California in warm weather.

The precooling of citrus fruits is worthy of consideration from other points of view. It appears to be possible to save ice in transit by loading the fruit in a cold rather than a hot condition, and it seems to make it possible to increase the freight-carrying capacity of a car if the fruit is properly cooled, without increasing the probability of decay. Theoretically the heat withdrawn in reducing a carload of 384 boxes of oranges from 70° to 40° F. is equivalent to the melting of about 2.6 tons of ice. The rest of the ice used in transit is consumed in protecting the fruit against the heat that comes in through the car and in cooling the car itself. The cars, however, have to be iced before loading when cold fruit is shipped in them, a practice that is not followed under ordinary icing. The saving of ice in precooled fruit when the cars are reiced as often as they are under ordinary icing is slight and does not appear to be of practical importance. The saving comes, however, from the fact that it does not seem necessary to reice precooled fruit during the first part of the trip as often as it is done in ordinary icing. In the shipments in which the temperatures in the cars have been under observation during the transcontinental trip, the temperature of the fruit cooled to 35° and 40° F. has not begun to rise, even in hot weather, until a third or a half of the transcontinental trip has been covered, while in cooler weather the cars have covered the entire trip to New York without a detrimental rise in temperature, often arriving with at least a ton of ice in the bunkers. Under regular icing the cars are reiced six or eight times during a transcontinental trip. Representative records of precooled cars shipped from California with initial icing only are shown in figures 24 and 25.

It is not intended to draw conclusions from the data at hand as to the effect of precooling as a means of saving ice, but rather to present a limited amount of data to show that this phase of the subject is worthy of careful consideration on the part of shippers and transportation companies.

The second point worthy of consideration is the possible increase in the freight-carrying capacity of a car when loaded with fruit that has been cooled properly for shipment. Under the present method of shipment, the minimum freight weight of a carload of perishable produce is established not by the actual carrying capacity of the car, but by the height to which it is safe to load the car without excessive decay in the top tier or tiers of fruit and by the spacing between the packages that it is necessary to leave for a free circulation of air.

In the experimental shipments of the Bureau of Plant Industry, a number of 40-foot cars have been forwarded with 549 instead of 384 boxes, the latter number being a standard load under ordinary icing. The increase has been accomplished by loading the cars 7 rows of boxes wide, leaving all of the space next to the walls of the car, and 3 tiers high, the upper tier being laid on the side, instead of 6 rows wide and 2 tiers high, as loaded under ordinary icing. The standard method of loading is shown in figure 3. The method of loading with 549 boxes is shown in figure 13. Under the latter method of loading the fruit may arrive in New York in hot weather with a difference in temperature of 5 to 10 degrees between the top and bottom tiers of fruit, as shown in figure 23, but as the temperature of the fruit is low when it is loaded, it appears to be safe to ship oranges in this manner in cool weather. In hot weather the cars can be loaded 2 tiers high and 7 rows wide, making 448 boxes. In the first case the capacity of the car is increased 165 boxes, or 11,880 pounds, and in the second case 64 boxes, or 4,608 pounds. In a train of 30 cars the load is increased 356,400 pounds in the first case or 138,240 pounds in the second without adding dead weight to be hauled in the form of extra cars.

This phase of the subject seems worthy of careful consideration on the part of shippers and transportation companies, especially in a time of car shortage.

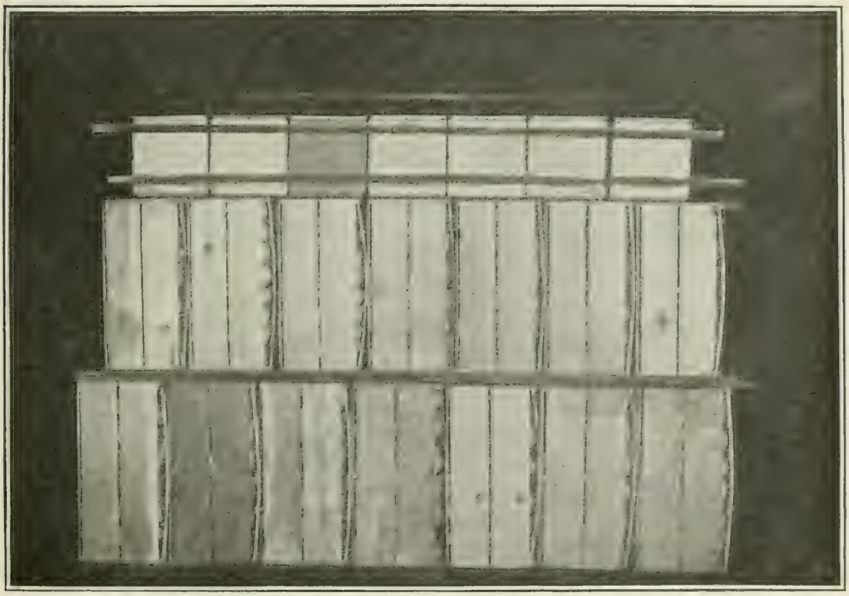

FIG. 13.—Boxes of oranges packed in accordance with the method used in loading a car with 549 boxes.

HISTORICAL DATA ON THE PRECOOLING OF ORANGES.

The first precooling of oranges was done at the plant of the Los Angeles Ice and Cold Storage Company, Los Angeles, Cal., in the spring of 1905. At that time several carloads of fruit were cooled to 35° to 40° F. in the warehouse for the Bureau of Plant Industry, and, through the cooperation of this company, about 10 loaded cars were cooled by forcing cold air from a coil room in the cold-storage house through ducts which led to the car and back to the coil room. The cold air could be forced in either direction through the cars. A general view of the plant used in 1905 is shown in Plate IX, figure 1.

The same line of work was continued in 1906 by the Bureau of Plant Industry, the fruit being cooled in the cold-storage warehouse.

A 3-ton ice machine was installed by a commercial company in a packing house at Arlington, Cal., in the spring of 1906, from which cold air was forced through a loaded car and back over a series of ammonia coils, and so on continuously around the circuit. The plant was built on a so-called intermittent vacuum principle, the object being to reduce the atmospheric pressure in the car frequently by a fan, thereby drawing the warm air out of the packages, to be replaced by the cold air when the cold current was again turned on. The capacity of this plant was too small for the purpose of either a practical or experimental demonstration of its value.

In the spring of 1907 the Bureau of Plant Industry had erected, under the direction of Mr. S. J. Dennis, expert in refrigeration, an experimental plant in cooperation with the Los Angeles Ice and Cold Storage Company, for the purpose of making accurate tests of the cooling of oranges in cars by forcing cold air through the cars. This plant consisted of two 30-inch-square insulated ducts leading from an ammonia coil room capable of supplying from 16 to 20 tons of refrigeration in 24 hours. With a motor and fan the cold air was forced in either direction through the car and back to the coil room. The temperature of the air was varied from 20° F. when first entering the car to higher temperatures. It was forced through the car at different velocities and in volume varying from 4,500 to 6,000 cubic feet a minute. This plant is shown in Plate IX, figure 2. It is hoped to present a report on this plant from the engineering point of view and a discussion of the cold storage of oranges in a future bulletin of the Bureau of Plant Industry on "The Cooling of Fruit for Shipment."

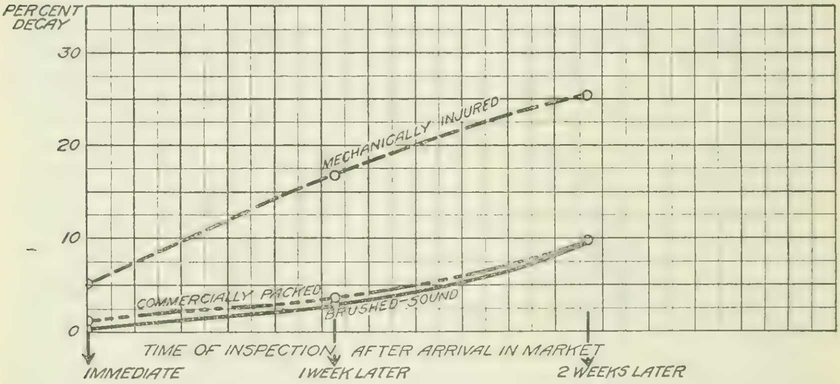

FIG. 14.—Diagram illustrating the percentage of decay upon arrival in market and for two weeks thereafter of precooled oranges handled carefully, 1907.

In addition to the work at the plant at Los Angeles, Cal., extensive shipping experiments were conducted by the Bureau of Plant Industry in 1907 with fruit cooled in cold-storage plants in different parts of the State. A few cars were cooled also at the 3-ton plant at Arlington, Cal., by different parties, and about 300 cars of fruit were cooled commercially in different cold-storage warehouses, the fruit having been stored primarily on account of a shortage in cars.

During the summer of 1907 an experimental precooling plant was erected by interests connected with the Santa Fe Railroad at San Bernardino, Cal., and another plant at Roseville, Cal., by interests connected with the Southern Pacific Company.

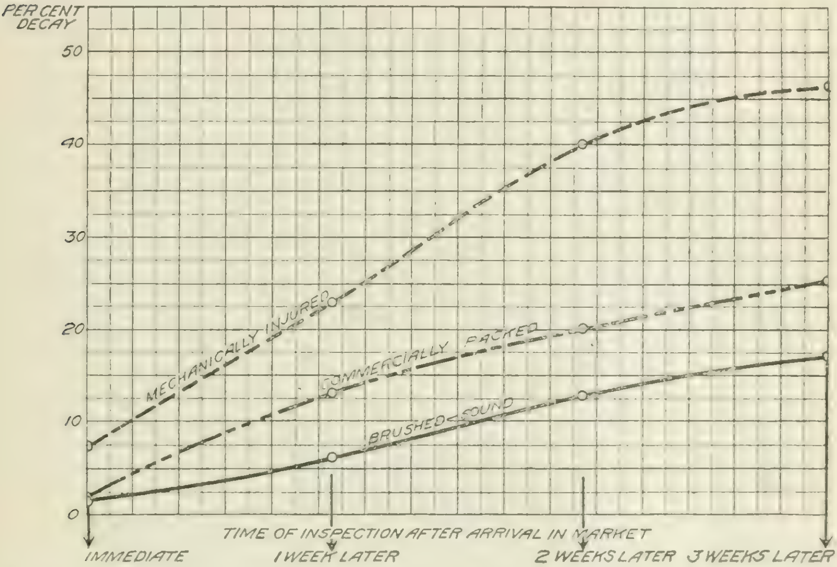

FIG. 15.—Diagram illustrating the percentage of decay upon arrival in market and for three weeks thereafter of oranges handled roughly, shipped under ice, 1907.

THE KEEPING QUALITY OF ORANGES AFTER ARRIVAL IN MARKET.

During the season of 1907 data have been secured on the keeping quality of oranges after arrival in market, the fruit having been prepared for shipment in different ways in California. The shipments included apparently sound brushed and washed fruit, commercially packed fruit, and mechanically injured fruit. Shipments were forwarded under ventilation, under ice, and after precooling, but not under conditions that make a comparison of the three methods feasible.

On arrival in New York the fruit was held for different lengths of time in a storeroom of a wholesale fruit merchant, and the decay was determined at the end of each succeeding week in storage. Shipments of this type arrived during April, May, and June.

One series of tests included the regular commercial shipments of a large corporation whose fruit is handled in the groves and packing houses with extreme care. The fruit is the same as that represented by the results discussed on page 45. All of it was forwarded under ventilation. The decay developed at different lengths of time after arrival in New York is shown in the following table:

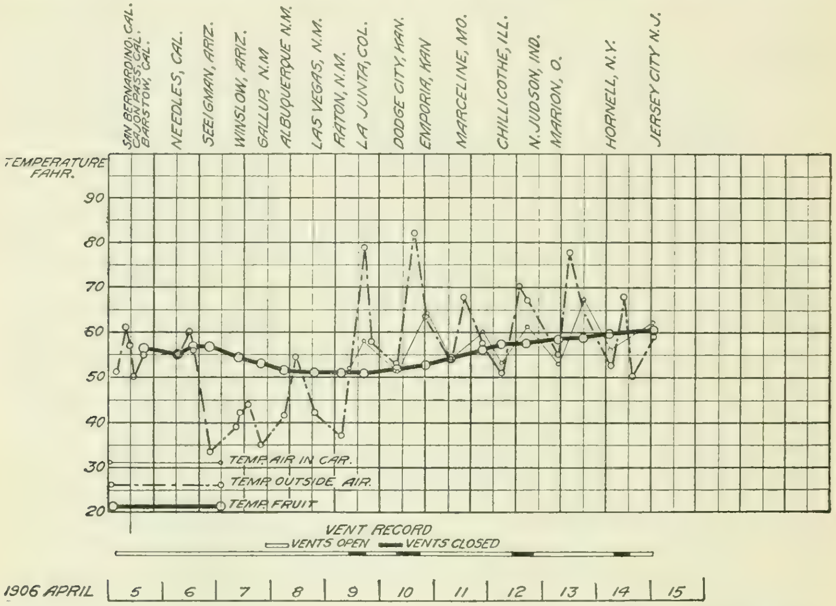

FIG. 16.—Diagram showing the temperature record of a carload of oranges shipped under regulated ventilation, April, 1906.

TABLE VIII.—*Percentage of decay in carefully handled oranges, shipped under ventilation, after arrival in New York, 1907.*

Character of oranges shipped.	Time of inspection.			
	On arrival.	After 1 week.	After 2 weeks.	After 3 weeks.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Commercially handled fruit	2.4	5.0	9.1	11.1

There was also forwarded from this house in June, after precooling, some carefully selected fruit, commercially packed fruit, and mechanically injured fruit. The decay in the different lots at different lengths of time after arrival in New York is shown in the following table, and also in figure 14 (p. 56):

TABLE IX.—*Percentage of decay in precooled oranges handled carefully, after arrival in New York, 1907.*

Character of oranges shipped.	Time of inspection.		
	On arrival.	After 1 week.	After 2 weeks.
	Per cent.	*Per cent.*	*Per cent.*
Apparently sound fruit	0.4	2.8	9.7
Commercially handled fruit	1.2	3.6	9.7
Mechanically injured fruit	5.2	16.7	25.4

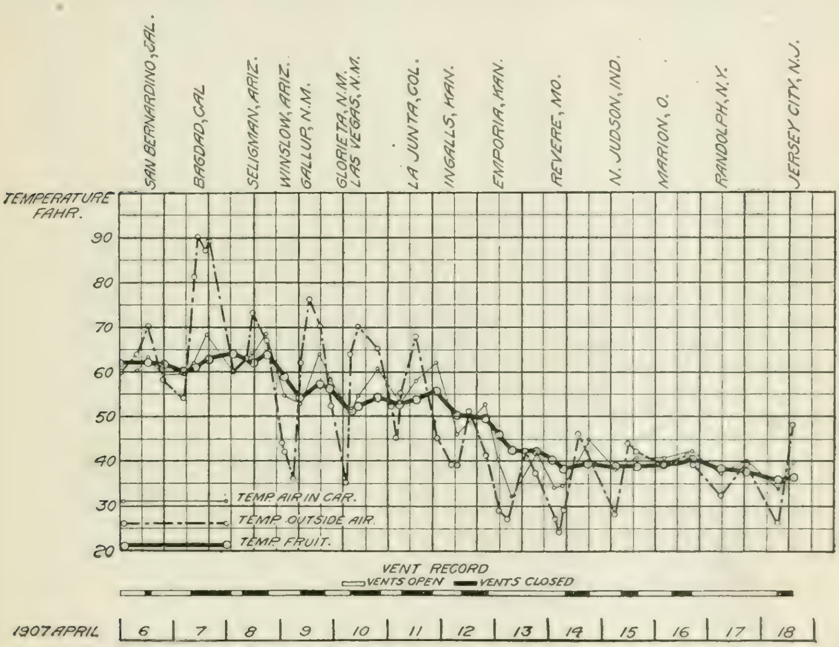

FIG. 17.—Diagram showing the temperature record of a carload of oranges shipped under regulated ventilation, April, 1907.

These data are comparable with the decay under ventilation so far as the commercially packed fruit is concerned. There was a little less decay in the precooled than in the ventilated fruit on arrival, and the development after arrival was slightly less. The difference shown is so slight as to be of no practical value except to indicate that precooled fruit that is reasonably sound is not more likely to decay after arrival in market than equally sound ventilated fruit. The increase was slightly less in the apparently sound fruit and greatest in the injured fruit.

The following table shows the amount of decay in fruit from houses where the oranges handled were picked and packed rather roughly, the fruit arriving during May and June under ice. The data are shown also in figure 15 (p. 57).

TABLE X.—*Percentage of decay in oranges handled roughly, shipped under ice, after arrival in New York, 1907.*

Character of oranges shipped.	Time of inspection.			
	On arrival.	After 1 week.	After 2 weeks.	After 3 weeks.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Apparently sound fruit	1.4	6.1	12.7	17.0
Commercially packed fruit	1.9	13.0	20.7	25.3
Mechanically injured fruit	7.4	22.9	39.9	46.1

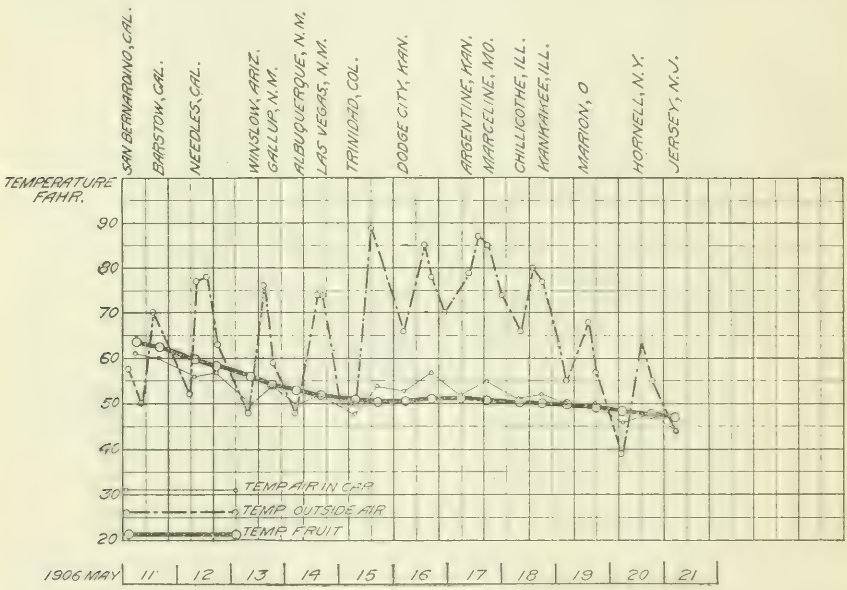

FIG. 18.—Diagram showing the temperature record of a carload of oranges shipped under regular icing, May, 1906.

This table shows the least development of decay in the apparently sound oranges and the greatest development in the mechanically injured fruit. The increase in decay in the commercially packed fruit, which contains more or less injured fruit, is greater than the decay in the sound fruit from which the oranges showing visible mechanical injuries have been eliminated.

The data on the keeping quality of the fruit in New York, taken as a whole, show clearly that sound fruit to start with is the basis for good keeping quality after arrival in market, as well as the basis for soundness on arrival: that carefully handled sound fruit keeps as well when shipped under precooling as ventilated fruit, but that unsound fruit having the decay retarded during shipment either by precooling or by icing decays badly when exposed to a warm atmosphere. The general impression that iced fruit decays more quickly than ventilated fruit when exposed to warm air is usually true so far as oranges that are mechanically injured are concerned, as the injured fruit is more likely to develop decay in transit under ventilation, but it is not well founded when applied to sound fruit.

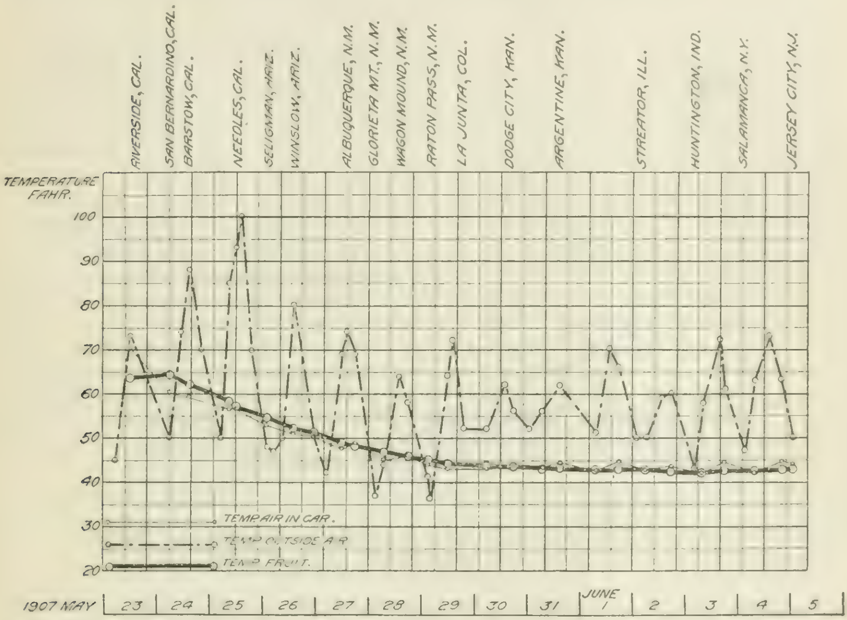

FIG. 19.—Diagram showing the average temperature record of two carloads of oranges shipped under regular icing, May, 1907.

THE INVESTIGATION OF THE TEMPERATURE OF ORANGES WHILE IN TRANSIT.

During the spring of 1906 and that of 1907 an investigation was made of the changes that occur in the temperature of the fruit, the air in the car, and the outside air during the movement of cars of fruit across the continent under ventilation, icing, and with fruit cooled before shipment and forwarded under several conditions of icing. The records were taken by Mr. G. W. Hosford and Mr. H. M. White, who made several transcontinental trips with train loads of oranges, reading the thermometers several times a day by entering the cars at the icing stations and other stopping points.

This investigation was made possible through the cooperation of the railroads in allowing the icing in transit, the reading of the thermometers, and other matters connected with the investigation to be done by, or under the direction of, the representatives of the Bureau of Plant Industry. The records appearing in this discussion were made in cars forwarded over the Santa Fe route.

From three to six thermometers were placed in each car, one to determine the temperature of the air just above the boxes of fruit, the others to determine the temperature of the fruit itself. These latter were inserted in oranges in the packed boxes. With the exception of a few cases noted, the fruit temperatures were taken in the upper half of boxes in the upper tier midway between the door and the end of the car, one thermometer being placed in an orange next to the outside of the box, and another in an orange in the inside or center of the box. For this purpose special long mercurial thermometers were used which could be read without being removed from the orange. The fruit temperature shown in the following diagrams is the average of the inside and outside fruit temperatures. In some cars a thermometer was placed in the lower half of a box in the lower tier in front of the door. All of the records were made in standard 40-foot refrigerator cars loaded with 384 boxes, except as noted. The diagrams that follow cover two representative records under each method of shipment.

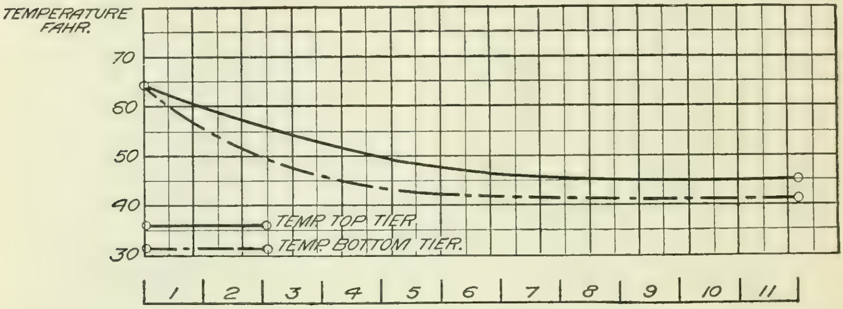

FIG. 20.—Diagram showing the temperature change of the oranges in the top and bottom tiers of boxes in a car shipped under regular icing.

TEMPERATURE RECORDS IN VENTILATED CARS.

The accompanying chart, figure 16, shows the temperature record of a car shipped in April, 1906. The record of the temperature of the air of the car was not begun until the train reached the vicinity of Raton, N. Mex. This car was forwarded under regulated ventilation: that is, the ventilators, or ice plugs, in each end of the car were supposed to be closed whenever the outside air was warmer than the fruit and were opened when the outside air was colder. The regulation in this respect differs from the standard ventilation in practice, which usually provides, so far as the temperature is concerned, that the ventilators shall be closed whenever the outside temperature falls below 32° F., but does not provide against the rise in temperature in the car when the outside air is above the temperature of the fruit. The regulation of the ventilators in this car was not entirely accurate, as shown in the vent record at the bottom of the chart. The fruit temperature is an average of the temperature in the inside of a box in the top tier at the end of the car and the temperature in the fruit in a similar position in the center of the car.

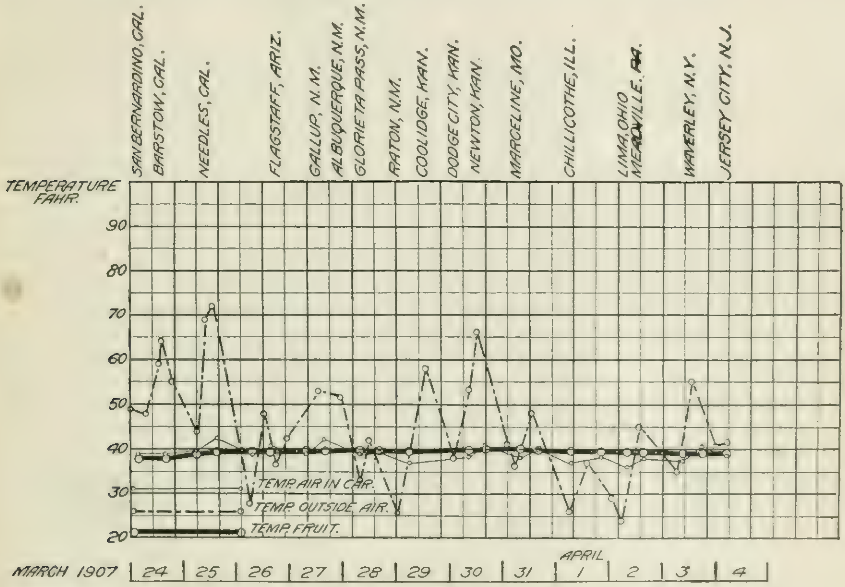

FIG. 21.—Diagram showing the temperature record of a standard carload of 384 boxes of oranges, precooled and shipped under regular icing, March and April, 1907.

It will be seen that the temperature of the air of the car lags behind the temperature of the outside air, while the lag in the fruit temperature is much greater than that of the air of the car. The fruit temperature changes slowly even when extreme differences occur outside.

The chart shown as figure 17, page 59, presents the temperature record of a car of oranges shipped under regulated ventilation in April, 1907, with somewhat different weather conditions from those occurring on the former trip.

The results of the experiments with this car demonstrate the fact that the temperature of the fruit changes much more slowly than the temperature of the outside air. It is worth noting that several times during the trip the temperature of the outside air fell below 32° F. and at one time dropped to 24° F. Notwithstanding the fact that the vents were open at the time, the temperature of the fruit, while falling steadily, did not reach a point where there was danger of freezing. Two days of this comparatively low temperature, April 13 and 14, 1907, only reduced the fruit from 50° to 38° F.

The substance of these records shows that the temperature of a carload of oranges under ventilation changes slowly in comparison with the temperature of the outside air; that the temperature outside may often fall to the freezing point or below without injury to the fruit, provided the fruit temperature is somewhat above that point at the time; that the danger of freezing depends on the persistence of and the degree of the low temperature without or the nearness of the fruit to it when the car enters a freezing temperature; and that the temperature of the fruit in transit would be more uniform if protection was made against warm temperatures as well as against cold in the handling of the ventilators. This suggests the need of an organized messenger service for the regulation of ventilated fruit cars, the ventilation to protect the fruit against both excessive cold and heat.

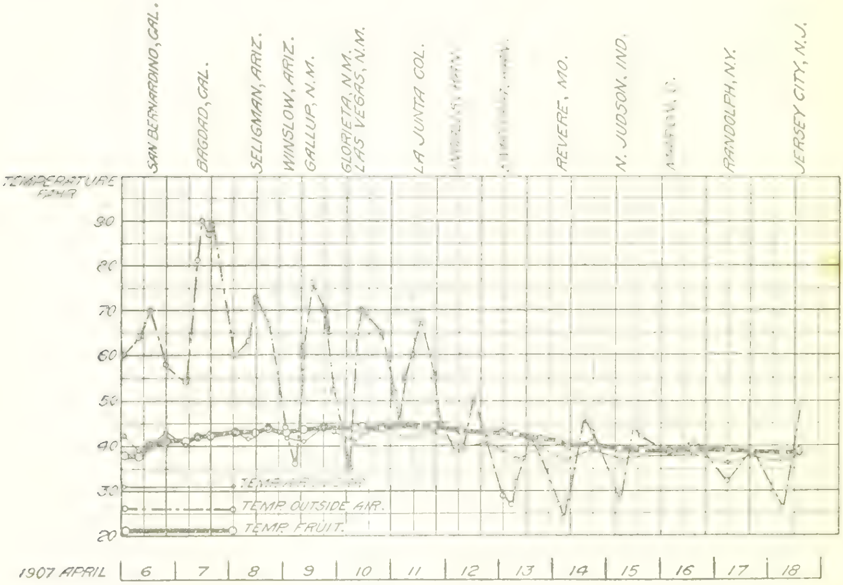

FIG. 22.—Diagram showing the temperature record of a carload consisting of 549 boxes of oranges, precooled and shipped under regular icing, April, 1907.

TEMPERATURE RECORDS IN ICED CARS.

The chart shown as figure 18, page 60, shows the record of a carload of oranges shipped under ice in May, 1906. The fruit started at 63° F., which is comparatively cool, and the outside air was also comparatively cool until the train reached western Kansas, after which it averaged considerably higher, except at the end of the trip. The temperature of the fruit was 63° F. in starting and reached 50° F. on the fifth day, but did not fall much lower, while the outside temperature remained high.

The record shown in figure 19 (p. 61) represents the average temperature of two cars shipped in the same train under ice in May, 1907. Each car showed practically the same temperature throughout the trip. The temperature of the fruit is the average of five different temperatures in each car. Two of them were taken in the usual place, halfway between the door and end of the car, two were taken in the top tier in the middle of the car and represent the average temperature of the inside and outside fruit, and the fifth in the center of the box in the lower half of the lower tier in front of the door. The fruit started at 64° F., reached 50° F. on the fourth day, and arrived in Jersey City at 43° F.

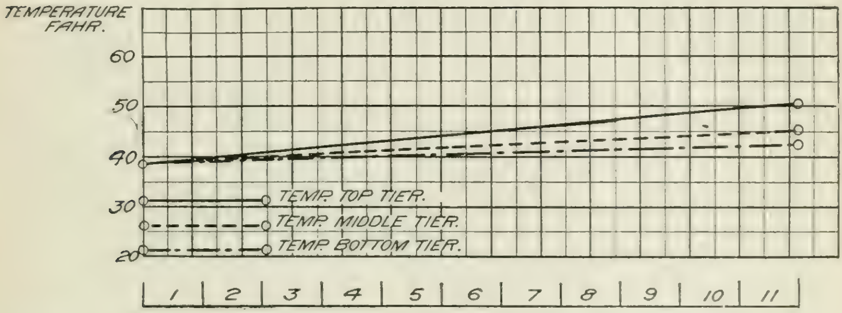

FIG. 23.—Diagram showing the temperature changes in the fruit in the bottom, middle, and top tiers in a carload of 549 boxes of oranges, precooled and shipped under initial icing only.

The chart shown as figure 20, page 62, shows the average cooling of the oranges in the top and bottom tiers of boxes in the cars shipped under ice in 1907. The temperature was taken in the upper half of the boxes in the top tier and the lower half of the boxes in the bottom tier. The bottom tier cooled faster than the top for several days, the maximum difference reaching 7 to 8 degrees on the third and fourth days of the trip. Gradually the extreme difference between the tiers disappeared, the temperatures of the two tiers from the seventh day remaining about 4 degrees apart.

The records show, in substance, that under icing the fruit is not reduced to a low temperature until a considerable part of the transcontinental trip has been covered, and that the fall in temperature in the top tier lags behind the bottom tier throughout the trip. These records indicate the reason why the fruit sometimes decays excessively when shipped under ice and why the top tiers of fruit, especially in cars of deciduous fruit, reach the market in an overripe and decaying condition. Many oranges leave California at a temperature of 80° F. or higher. The decay starts during the early part of the trip under the icing method, before the fruit is cooled.

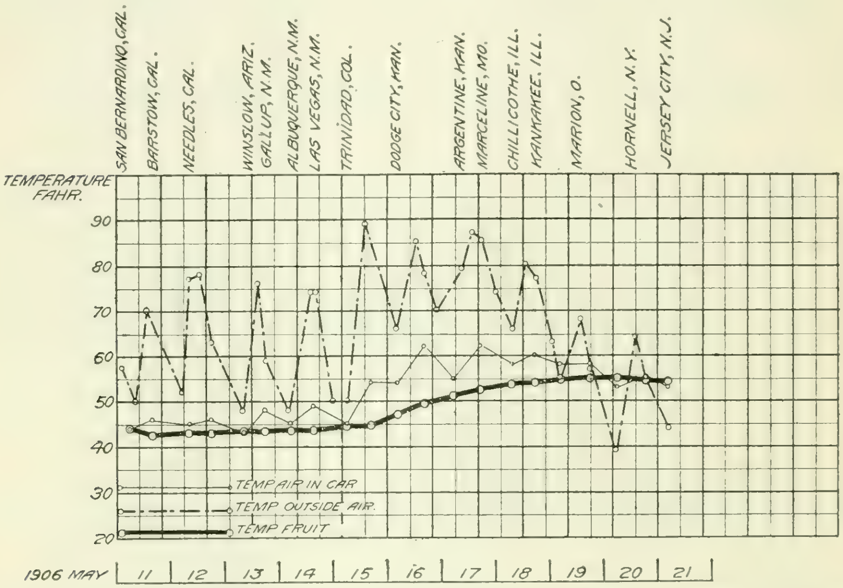

FIG. 24.—Diagram showing the temperature record of a carload of oranges, precooled and shipped under initial icing only, May, 1906.

TEMPERATURE RECORDS OF FRUIT COOLED BEFORE LOADING AND ICED REGULARLY IN TRANSIT.

The chart shown as figure 21 (p. 63) is a record of the temperature of a carload of oranges of 384 boxes placed in cold storage before loading and which left California in March, 1907, at a temperature of 38° F. The car was iced before the fruit was loaded and was reiced in transit at the regular icing stations. The temperature of the fruit remained practically constant throughout the trip, the air of the car changing slightly with the outside air.

The accompanying chart, figure 22 (p. 64), is a record of the temperature of a carload of 549 boxes of oranges placed in cold storage before loading and which left California in April, 1907, at a temperature of 38° F. The car was iced before the fruit was loaded and was reiced regularly in transit. All of the thermometers in this car were placed near the door. The fruit temperature is an average of the fruit next to the outside of a box in the third or top tier and the fruit in the center of the lower half of a box in the bottom tier. The temperature of the fruit rose to 45° F. during the first half of the trip and probably would have risen higher if the outside temperature had not been colder during the latter half of the trip.

The accompanying chart, figure 23 (p. 65), illustrates the average temperature of the fruit in the different tiers of a 3-tier car loaded with 549 boxes. The fruit was loaded into the car at a temperature of 38° F. Upon arrival in Jersey City it was found that the temperature on the top tier was 51°, the middle tier 48°, and the bottom tier 43° F. This is the largest difference that has been found in any of the 3-tier precooled cars under observation. The record is the result of reading the temperature of the fruit at the beginning and end of the trip and is not a continuous record from day to day.

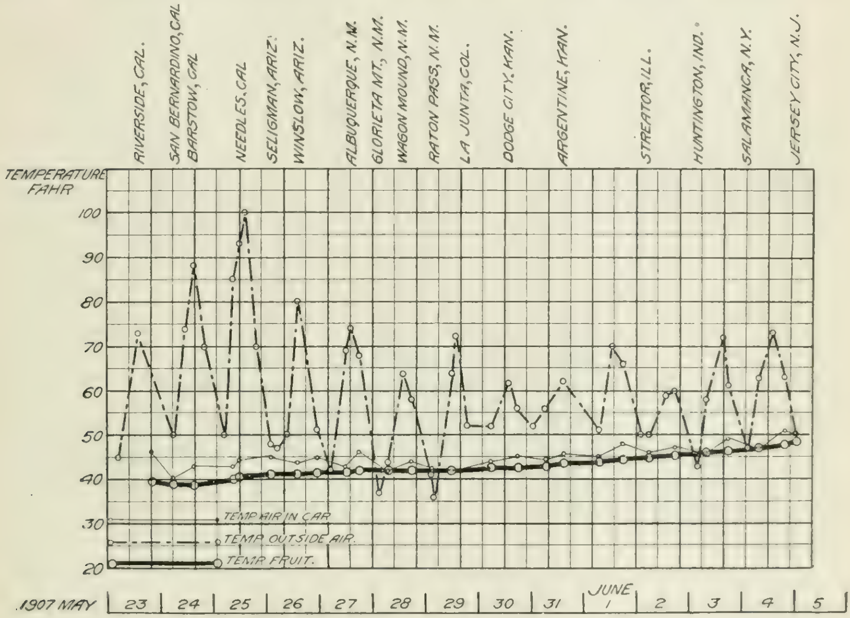

FIG. 25.—Diagram showing the temperature record of a carload of oranges, precooled and shipped under initial icing only, May and June, 1907.

TEMPERATURE RECORDS OF FRUIT COOLED BEFORE LOADING AND ICED IN CALIFORNIA ONLY.

The chart shown as figure 24 is a record of a carload of oranges placed in cold storage before loading and which left California in May, 1906, at a temperature of 42° F. The car was iced before loading and was reiced at San Bernardino before leaving California. It was not reiced during the rest of the trip. It arrived in Jersey City with about 700 pounds of ice in the two bunkers. During the first half of the trip the weather was reasonably warm, but the temperature of the fruit remained fairly constant. During the latter half, through Kansas and as far as Illinois, the outside temperature was higher. The temperature of the car then began to rise, the temperature of the fruit rising also from 45° to 55° F., but lagging considerably behind, with a tendency to recede during the cooler weather at the end of the trip. In this connection the record of the car under ice shown in figure 18, made in the same train, should be noted. In this car the fruit started at a temperature of 63° and did not drop below 50° F. during the warm weather. In the fruit precooled and iced in California only it started at 42° and rose during the latter half of the trip as high as 55° F. The condition of temperature in the precooled car is preferable so far as the decay of the fruit is concerned.

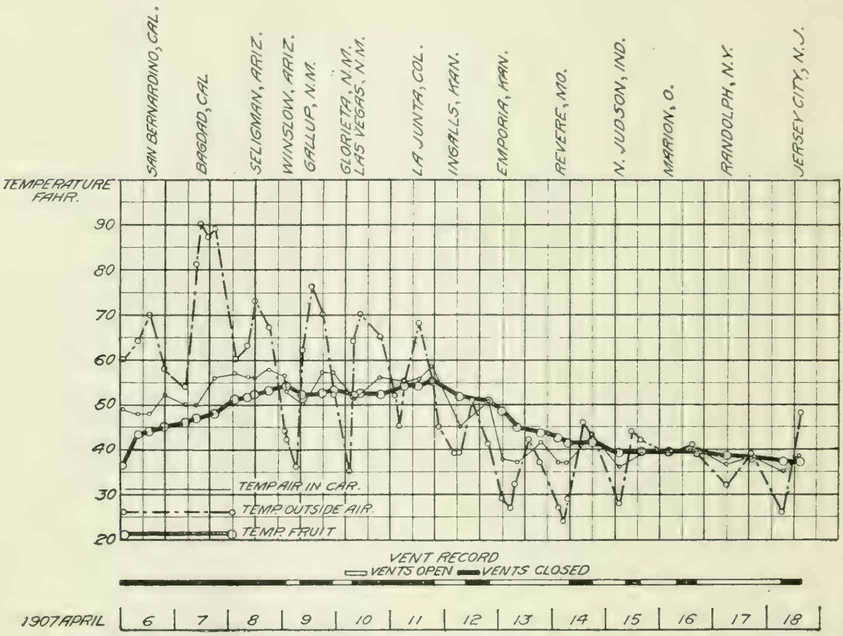

FIG. 26.—Diagram showing the temperature record of a carload of oranges, precooled and shipped without icing under regulated ventilation, April, 1907.

The chart shown as figure 25 is a record of a carload of oranges of 416 boxes placed in cold storage before loading and which left California in May, 1907, at a temperature of 39° F. This car was iced before loading and was reiced at San Bernardino before leaving California, but not during the rest of the trip. The car was loaded 7 rows of boxes wide on the bottom tier and 6 rows wide on the top tier. It arrived in Jersey City with 3,000 pounds of ice in the two bunkers. The temperature of the fruit rose gradually from 39° to 48° F. In this connection the record of the iced car shown in figure 19, which was in the same train, should be noted. The lower temperature during the latter half of the trip reduced the temperature of the fruit to a lower degree than the fruit in the iced car shown in figure 18, and at the same time it prevented as great a rise in the cold fruit as occurred in the car shown in figure 24. It also saved the ice as compared with the car shown in figure 24.

The chart shown as figure 26 shows the record of a carload of oranges placed in cold storage which left California in April, 1907, at a temperature of 37° F. The car was not iced either before or after loading. It was forwarded with the ice plugs inserted. The temperature outside was warm and the temperature of the fruit rose rapidly. After the train reached Winslow, Ariz., the temperature of the air at night began to fall below the temperature of the fruit, and from that point on the car was run under regulated ventilation. The record indicates that it is not safe, so far as the temperature of the fruit is concerned, to load precooled fruit in warm weather in a hot car and to forward it without ice.

SUMMARY OF PRECOOLING RECORDS.

The substance of the records under precooling demonstrates that the temperature remains fairly constant in fruit that has been cooled and is forwarded in a car iced before loading and iced regularly in transit; that the temperature of fruit cooled to about 40° F., forwarded in a car iced before loading, and reiced at San Bernardino, Cal., only, remains fairly constant for at least half of the transcontinental trip, when the temperature may begin to rise if the weather is warm; that it may be safe to ship oranges cooled to about 40° F. to points in the western half of the United States with California icing only, provided the time in transit is normal; that the fruit may be shipped across the continent in reasonably cool weather when handled under the preceding conditions; that the need of reicing in transit would probably have to be governed by the quantity of ice remaining in the bunkers at any point and not by a predetermined fixed rule, and that it is not safe to load cold fruit in a warm car and forward it without icing.

SUMMARY.

The citrus-fruit crop of California amounts to nearly 30,000 cars annually, of which the orange comprises from 85 to 90 per cent. The fruit is grown under intensive culture, and the handling, shipping, and marketing of the crop have resulted in the development of complex and highly specialized business practices.

The losses from decay in the orange during transportation formerly amounted to $750,000 to $1,500,000 annually. The decay is caused by a blue-mold fungus which enters the orange through mechanical abrasions in the skin. The most common forms of mechanical injury are those caused by the clippers in cutting the fruit from the tree, stem punctures, and scratches and bruises produced in the packing houses. Most of these injuries are invisible to the inexperienced eye. There has been a wide variation in the amount of injury in the fruit of different pickers, growers, and packing houses, the variation commonly running from 1 to 50 per cent. A good deal of the trouble has been related to methods of business which place a premium on the amount rather than the quality of the work done by the picker, the grower, or the packing house.

By holding in many packing houses in California fruit that has been picked at different periods of the season, in different sections of the citrus belt, and that has been handled in different ways, it has been shown that the fruit that is handled the least develops the least decay, while the fruit that shows the greatest amount of injury develops the most decay. From the standpoint of the packing house, the least decay develops in sound unbrushed fruit. Brushing increases it, washing increases it still more, and any treatment that cuts or tears the skin is followed by the greatest amount of decay.

There appears to be little difference in the amount of decay in oranges grown in different sections that have been handled in a similar manner, or in oranges picked from the same grove with equal care at different periods of the season, at least from January to May.

The "curing" of the orange for a few days before packing wilts the skin and in the early part of the season makes it pliable to handle. The curing is probably not harmful to uninjured fruit, but under the conditions of commercial handling in California the blue mold begins to develop in the injured oranges during the curing period, but does not develop far enough to be seen by the graders except in fruit that has been injured severely.

If the fruit is packed promptly after picking and is shipped at once in a cool temperature the decay may not develop in transit. The most progressive shippers now pack the fruit promptly after picking.

It is unnecessary to brush so large a proportion of the oranges as has been customary in the past, and the washing can be avoided by treating the groves properly for scale. The packing houses all through the citrus belt are being modified in the direction of more simple machinery.

The shipping experiments of the Bureau of Plant Industry during the last three years have included 297 shipments of fruit to New

York. The shipments have included oranges handled in different ways before packing. The fruit has been shipped at different lengths of time after packing, and it has been forwarded under ventilation, icing, and precooling followed by different conditions of icing.

From the standpoint of the handling of the fruit the least decay has developed under all methods of shipment in the sound, carefully handled oranges, and the greatest amount has developed in those that were mechanically injured. From the standpoint of the promptness of shipment after packing the least decay has developed in the oranges shipped immediately after packing, and the decay has increased in proportion as the time between packing and shipment has lengthened. From the standpoint of the method of shipment the least decay developed in the precooled fruit that was loaded in the cars in cold condition.

The cooling of the fruit to a temperature of about 40° F. before shipment appears to save ice in transit, as the cars do not require reicing as often as they do when forwarded under regular icing. It appears also to increase the freight-carrying capacity of a car by making it possible to load the boxes more closely than is safe under regular icing. From the standpoint of decay, precooling the fruit is not essential, as the decay can be avoided by handling the fruit carefully. Precooling retards decay temporarily, but does not remove the cause. It should supplement rather than take the place of careful handling.

In the market holding tests the fruit that has not been mechanically injured keeps the longest, while the greatest loss occurs in oranges that have been thus injured.

The temperature of the fruit changes slowly in transit. In ventilated cars there may be extreme changes in the outside air, and if the extremes do not persist long the changes in the temperature of the fruit are relatively slow. In iced cars the temperature falls relatively fast during the first few days, but a train may cover one-third of the trip across the continent before the temperature of the fruit reaches 50° F. The decay develops rapidly during the early part of the trip, while the fruit is warm. In a car in which the fruit is cooled to 40° F. or lower before shipment the temperature remains nearly constant if the car is reiced regularly in transit. In cool weather it remains fairly constant without additional icing after the car leaves California. In warm weather the reicing during the first half of the trip can be avoided, but the car may need reicing during the latter half of the trip.

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DESCRIPTION OF PLATES.

PLATE I. *Frontispiece.* Washington Navel oranges, showing blue-mold decay. The upper figure shows the stem cut short, with an injury in the fruit made by the clippers. The decay started at this injury. The lower figure shows an orange with a long stem and a puncture made by such a stem. The decay is developing around the injury. (Fruit considerably reduced in size.)

PLATE II. Washington Navel orange trees. Fig. 1.—One of the Washington Navel orange trees sent to California by the Department of Agriculture in 1873. Fig. 2.—A Washington Navel orange tree three years after planting.

PLATE III. California orange groves and a packing house. Fig. 1.—A typical view of bearing orange groves. The foreground shows contour planting to facilitate irrigation. Fig. 2.—Interior view of an orange packing house in southern California, with an old-style overhead sizing machine and gravity chutes leading to the bins. This type of house contains too much complicated machinery to insure careful handling of the fruit.

PLATE IV. Orange brushing machines. Fig. 1.—A common type of brushing machine with a hopper. Fig. 2.—A belt-carrying device placed over the brush to deliver the fruit from the hopper to the elevator. This device can be removed when it is desired to brush the fruit.

PLATE V. Machinery in use in an orange packing house in southern California. Fig. 1.—An automatic weighing machine in operation. Fig. 2.—One type of sizing machine in operation. The narrow carrying belts on either side are used to return to the graders poor fruit found in the bins.

PLATE VI. An interior view of a desirable type of orange packing house. This is a type of house without overhead or complicated machinery. The grading belt in the background is shown in detail in text figure 2. The drop from the grading belt to the sizers is necessary to allow room for the weighing machines. (From a photograph furnished by the manager of the packing house.)

PLATE VII. The washing of citrus fruits. Fig. 1.—A lemon washing machine in operation. The fruit is emptied into the tank of water at the right of the picture. It is then cleaned between revolving brushes in the circular tank and delivered on the canvas table at the left, where it is graded according to color. Similar machines are used in washing oranges. Fig. 2.—Washed oranges on drying racks.

PLATE VIII. Valencia oranges. The upper specimen was taken from a grove that had been thoroughly fumigated for the black scale. The lower specimen is from a grove that had not been fumigated for the black scale. The sooty-mold fungus on the upper part of the fruit grows in the honeydew exuded by the scale. Such fruit has to be washed. (Fruit considerably reduced in size.)

PLATE IX. The cooling of oranges in cars before shipment. Fig. 1.—The experimental plant used in 1905. Fig. 2.—The experimental plant erected and used in 1907.

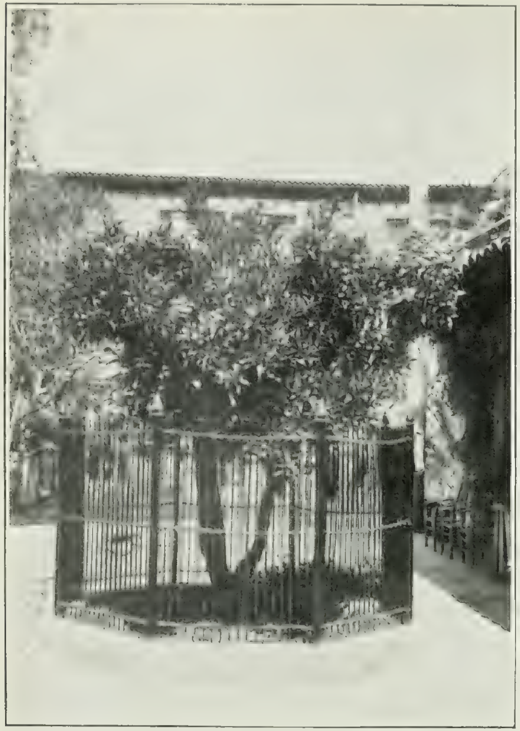


FIG. 1.—A TREE SENT TO CALIFORNIA BY THE DEPARTMENT OF AGRICULTURE IN 1873.

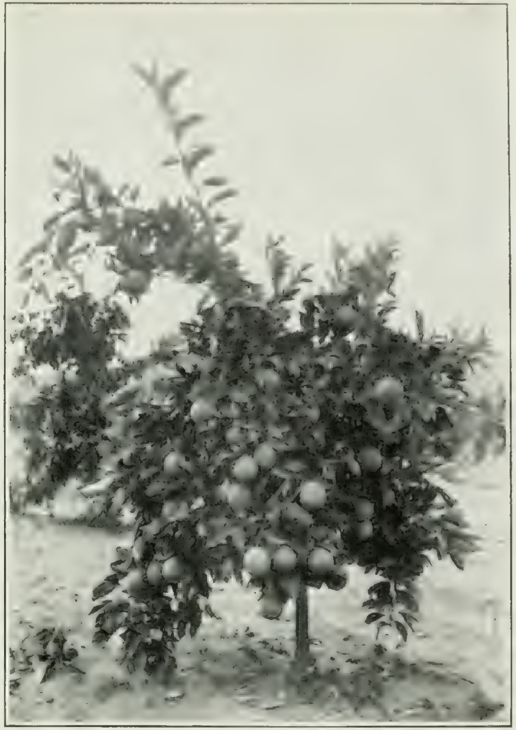


FIG. 2.—A TREE THREE YEARS AFTER PLANTING.

WASHINGTON NAVEL ORANGE TREES.

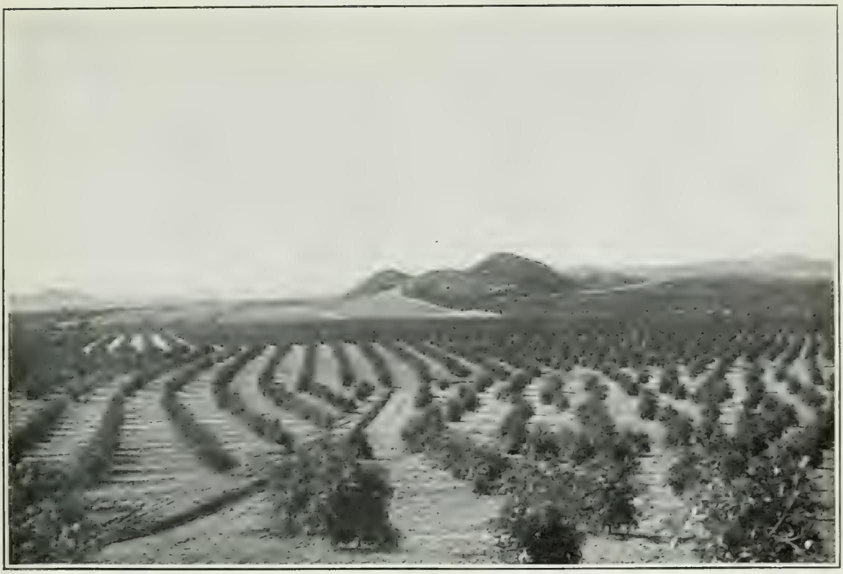


FIG. 1.—A TYPICAL VIEW OF BEARING ORANGE GROVES.

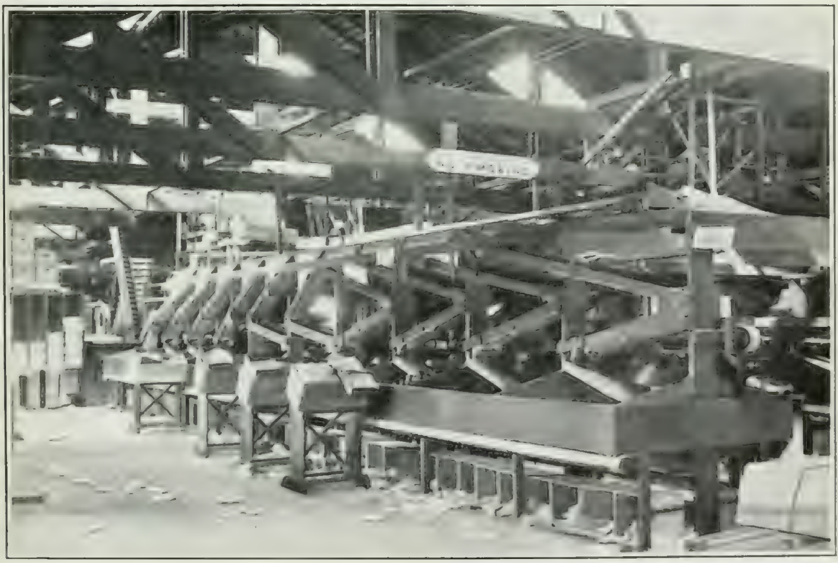


FIG. 2.—INTERIOR VIEW OF AN ORANGE PACKING HOUSE WITH AN OVERHEAD SIZING MACHINE.

CALIFORNIA ORANGE GROVES AND A PACKING HOUSE.

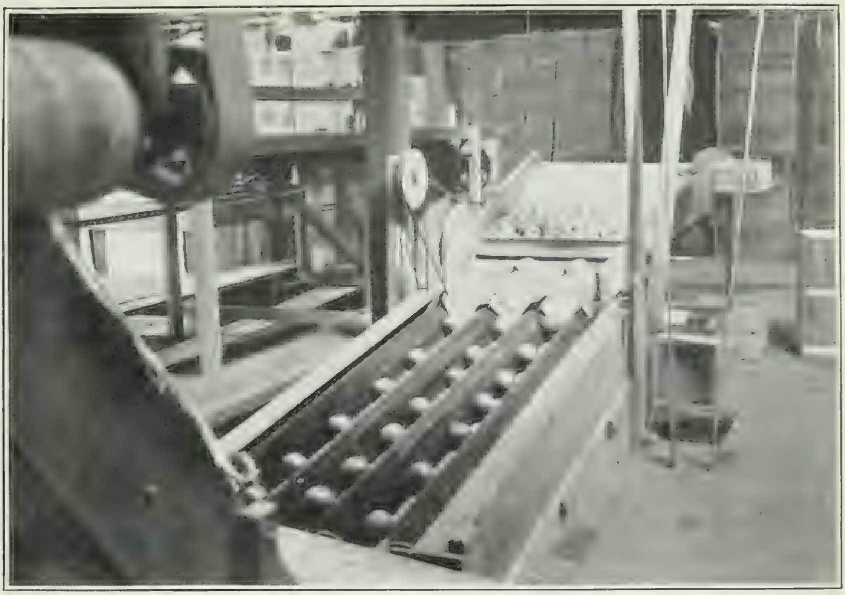


FIG. 1.—A COMMON TYPE OF BRUSHING MACHINE, WITH A HOPPER.

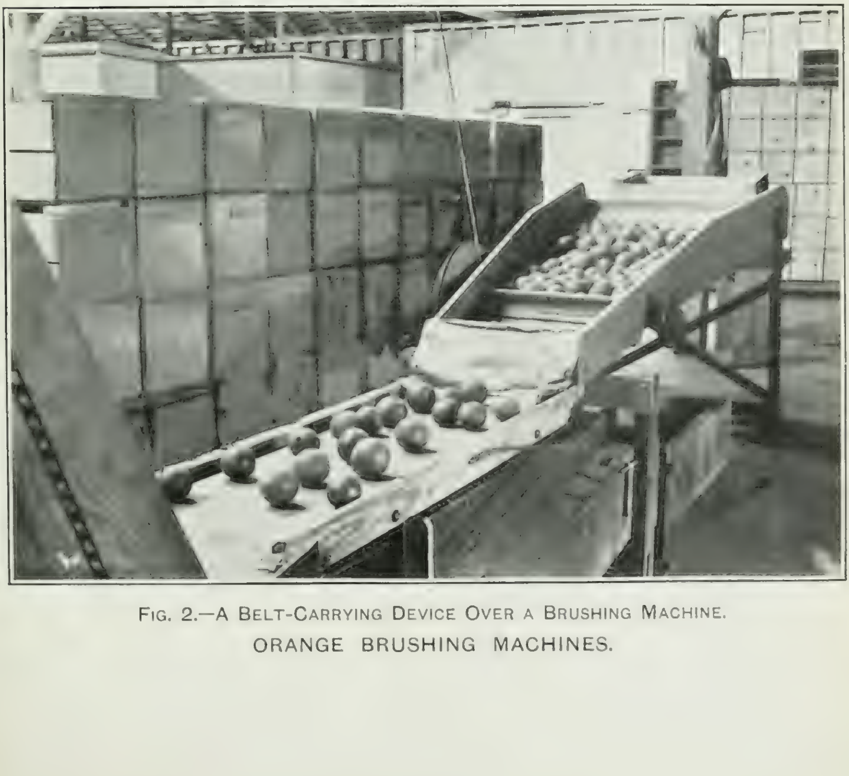


FIG. 2.—A BELT-CARRYING DEVICE OVER A BRUSHING MACHINE.

ORANGE BRUSHING MACHINES.

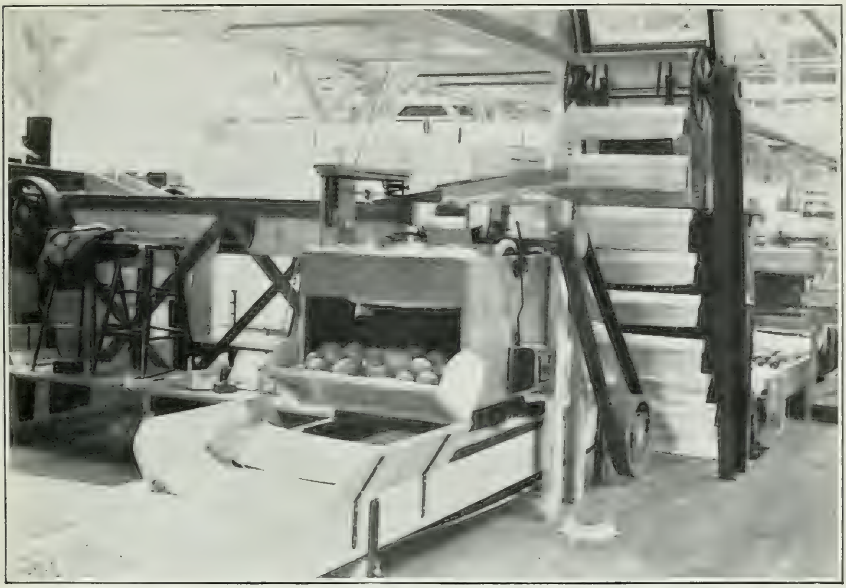


FIG. 1.—AN AUTOMATIC WEIGHING MACHINE

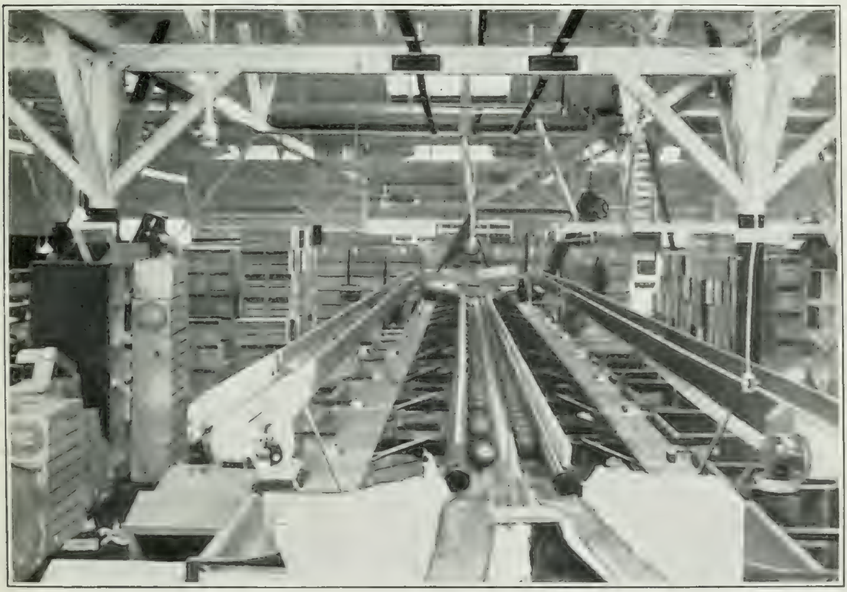
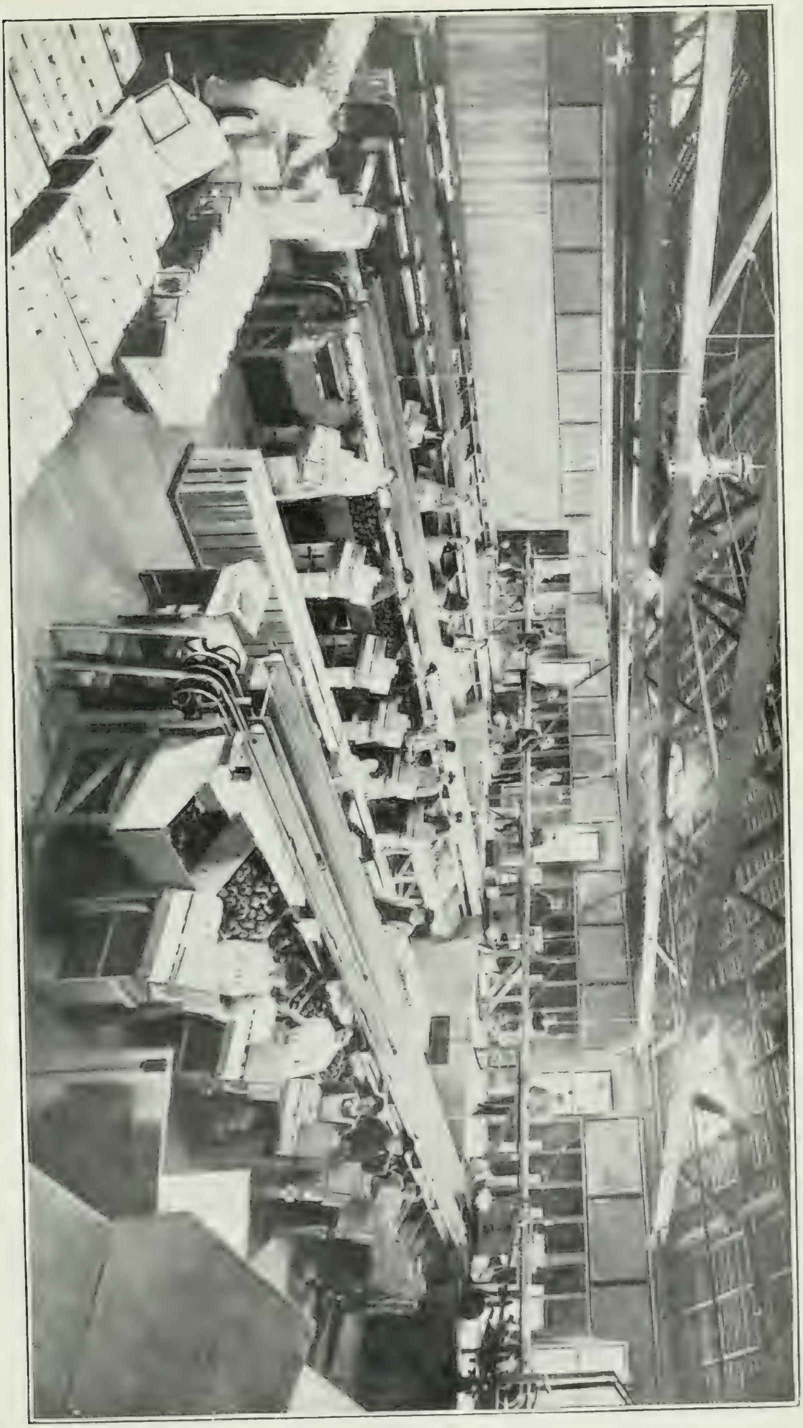


FIG. 2.—A TYPE OF SIZING MACHINE.

ORANGE PACKING-HOUSE MACHINERY.



AN INTERIOR VIEW OF A DESIRABLE TYPE OF ORANGE PACKING HOUSE.

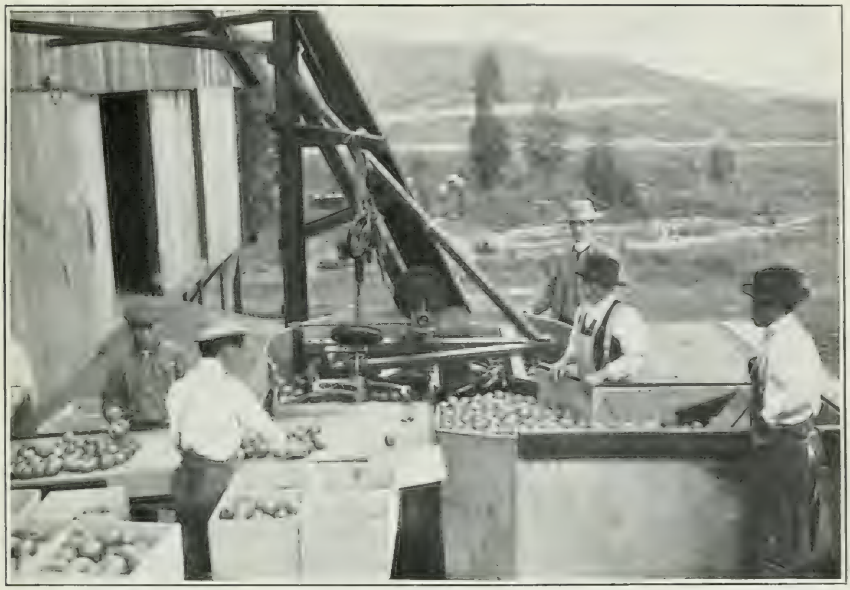


FIG. 1.—A LEMON WASHING MACHINE IN OPERATION.

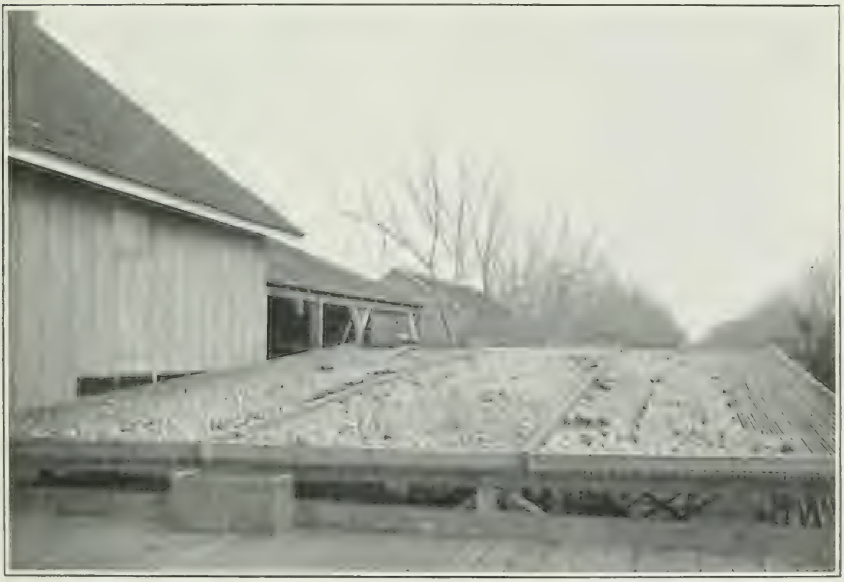
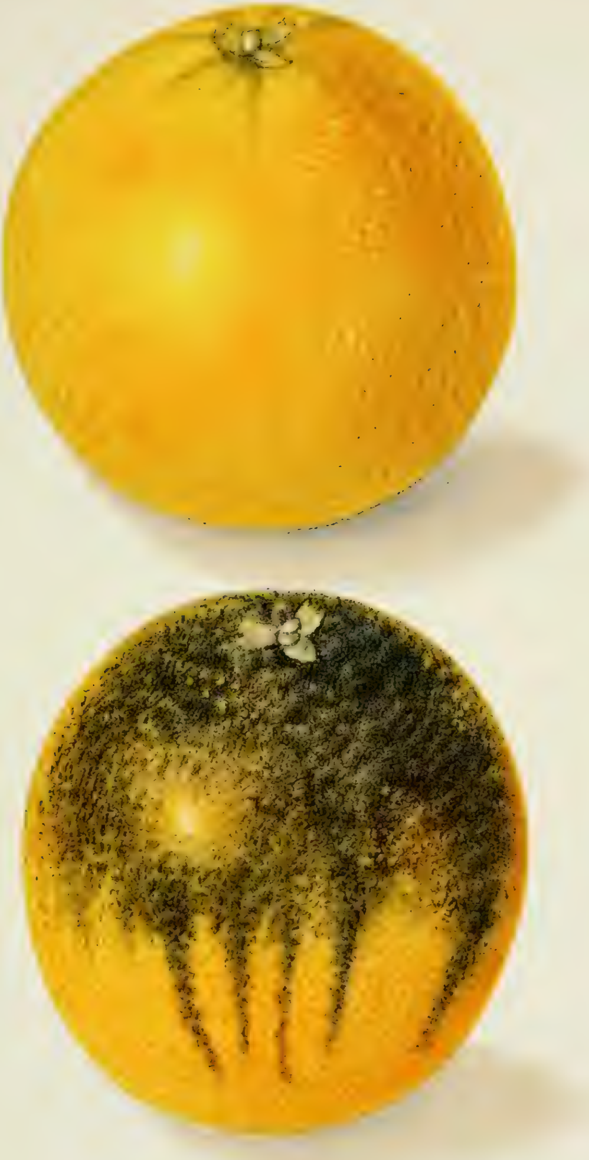


FIG. 2.—WASHED ORANGES ON DRYING RACKS.

THE WASHING OF CITRUS FRUITS.



VALENCIA ORANGE.

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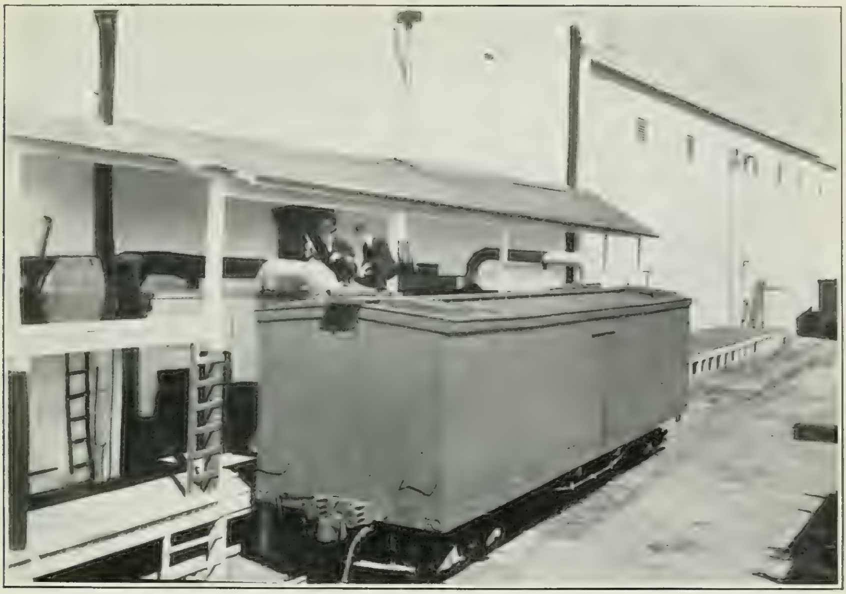

FIG. 1.—THE EXPERIMENTAL PLANT USED IN 1905.

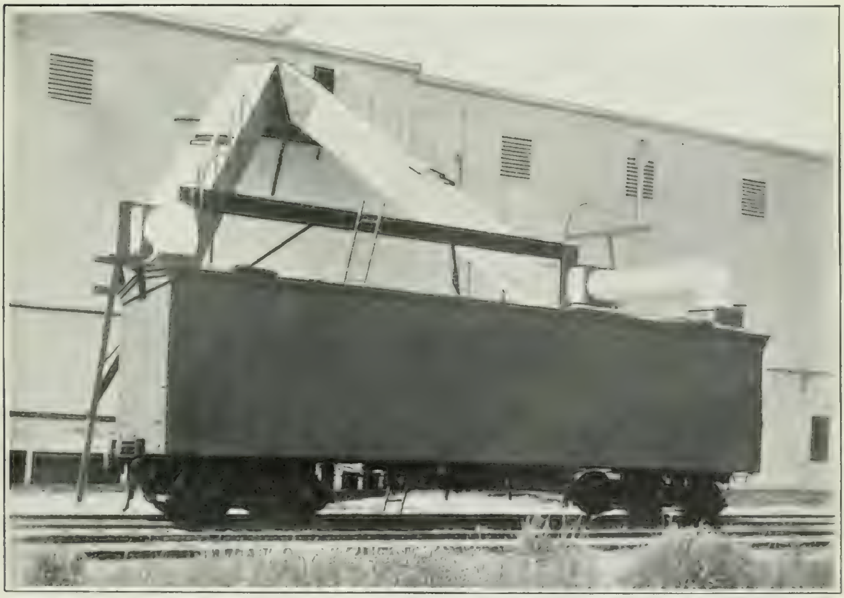

FIG. 2.—THE EXPERIMENTAL PLANT USED IN 1907.

THE COOLING OF ORANGES IN CARS BEFORE SHIPMENT.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 124.

B. T. GALLOWAY, *Chief of Bureau.*

THE PRICKLY PEAR AS A FARM CROP.

BY

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Assistant Agriculturist, Farm Management Investigations.

Issued February 19, 1908.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., December 6, 1907.

Sir: I have the honor to transmit herewith, and to recommend for publication as Bulletin No. 124 of the series of this Bureau, a manuscript entitled "The Prickly Pear as a Farm Crop," by Dr. David Griffiths, which has been submitted by Prof. W. J. Spillman, Agriculturist in Charge of Farm Management Investigations, with a view to publication.

This is the first report based upon actual experiments dealing with the cultivation upon a field basis of any of the peculiar and interesting plants known as prickly pears. They have been utilized to a large extent in the economy of the stock business of southern Texas, but have never before been cultivated as a field crop in this country.

The author desires to acknowledge his indebtedness in the conduct of these investigations to the cooperation of Mr. Alexander Sinclair, upon whose ranch the work is being carried on, and to his son, Mr. William Sinclair, who has so faithfully cared for the plantation.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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B. P. I.—327.

THE PRICKLY PEAR AS A FARM CROP.

INTRODUCTION.

No attempts have been made hitherto to cultivate prickly pear as a regular crop in this country. The nearest approach to it was made by some of the old mission fathers of California, who imported cuttings, probably from Mexico, and planted them in hedges, where they served the double purpose of barriers against stock and as food for man. That they received any appreciable degree of cultivation, however, is very doubtful. They were probably grown in much the same manner that the so-called cultivated prickly pears are grown in Mexico to-day.

An extended use has been made of the native crop at various times for the past fifty years or more in southern Texas, but it has mainly been spasmodic, lasting only until "the drought was broken," except for sheep and goats, which are fed on it regularly, and in the case of the few dairymen who have made it a practice to feed it for a portion of each year. In short, the prickly pear has been considered an emergency feed, to be used only when other feeds fail. Even enthusiastic pear feeders in Texas thought that the results to be obtained from planting and cultivating an experimental tract would only be "very interesting." There was little expectation that the plants would respond to cultivation as they have done. The facts presented in this paper, however, show that the prickly pear will produce, under proper cultural methods similar to those used for the common staple crops, yields of roughage superior to some of the standard agricultural crops of the region, especially when an off year occurs. It has proved itself under cultivation not only an emergency feed but an insurance against famine, as well as a plant which can be grown and depended upon regularly as a farm crop.

The investigations of this subject at the present time are very opportune indeed, because the demand for such a crop is not as great in southern Texas now as in a thickly settled region, giving ample time for growers to learn just the position that the crop should occupy in the economy of their operations. Land is still changing hands in southern Texas in 200-section blocks, and all of it has more or less prickly pear growing upon it. It is not to be expected that holders of such areas will be concerned with the culture of prickly pear any more than they will be concerned with the culture of any other crop, for they have plenty of pear growing wild in their pastures now, often more than they can possibly use. Settlement and subdivision of holdings are taking place very rapidly, however, throughout the region, and the time is not far distant when the whole country will be divided up into small holdings where the small farmer will depend upon a variety of crops and where use will be found for a crop like this which can withstand a protracted drought of two or three months or more without artificial irrigation.

Indeed, many large communities now exist which need to grow some crop of this kind. In the vicinity of the larger cities dairymen have for years been in great need of roughage upon which they can depend, as well as succulent feed, which is not usually available during one-half of the year. In the vicinity of San Antonio, Tex., the feeding of the prickly pear has been so extensive during the past six years that the pastures have been practically depleted of it within a radius of eight miles from the city. Still, the hauling of the crop such distances is doubtfully profitable, especially when it must now almost invariably be paid for. When it is remembered that a cow will eat in the neighborhood of 100 pounds a day, it will be readily understood that to haul pear such distances for feed is very burdensome. These dairymen could much better afford to turn some of their native brush pastures into cultivated fields of prickly pear, wherein they could feed the crop with no handling and be insured against a shortage of roughage. The conditions around San Antonio are practically duplicated near Laredo.

Attention should be called here to the fact that this report applies to the experiments conducted at San Antonio only and that the territory to which the experiments apply extends, roughly, from Houston to Del Rio and from Austin to Brownsville. Investigations along similar lines are being conducted in New Mexico, Arizona, California, and Florida, but it is not time to report upon them yet.

CLIMATIC CONDITIONS OF THE REGION.

According to Bulletin Q, "Climatology of the United States," issued by the United States Weather Bureau, the mean annual precipitation for the city of San Antonio for the past eighteen years has been 28.4 inches. The total amount for the driest year for the same period was 15.9 inches, and the total for the wettest year, 40.5. These figures are very important in the interpretation of these investigations and show that the work is being done in a region of relatively high average annual rainfall. These tables do not, however, tell the whole story. It is necessary to study the monthly totals in order to appreciate the conditions of moisture prevailing. The following table is compiled from monthly totals of precipitation for the past ten years and shows in a striking way how irregular is the distribution of moisture:

TABLE I.—*Monthly totals of precipitation for San Antonio, Tex., for the ten years from 1897 to 1906, inclusive, in inches.*

Month.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	Monthly extremes.
January	1.59	0.46	0.38	5.42	0.41	0.70	2.39	0.30	0.88	0.29	0.30 to 5.42
February	15	1.16	.31	.34	.71	.55	7.88	.64	1.62	1.07	.15 to 7.88
March	1.65	1.47	*T.	4.34	.54	.12	1.29	.16	2.74	1.29	*T. to 4.34
April	1.84	1.46	2.60	9.11	.59	2.31	1.74	3.25	6.08	3.94	.59 to 9.11
May	3.13	1.06	2.22	4.47	2.47	3.14	1.95	5.93	4.11	.86	1.06 to 5.93
June	2.19	7.06	4.32	.78	1.86	.02	4.75	1.73	6.01	.62	.02 to 7.06
July	.28	2.24	2.85	2.24	3.79	3.85	7.52	3.50	2.82	4.34	.28 to 7.52
August	.40	3.35	.00	4.05	.96	.00	.20	1.97	.51	2.25	.00 to 4.05
September	1.61	1.32	.57	.97	4.20	5.52	2.96	7.74	1.80	1.74	.57 to 7.47
October	1.35	.03	1.31	2.94	.12	2.54	1.61	2.86	1.83	1.09	.03 to 2.94
November	.43	1.34	1.70	1.82	.64	3.53	*T	.24	2.63	1.33	*T. to 3.53
December	1.34	1.54	3.39	.70	.15	2.51	.82	1.06	1.56	1.60	.15 to 3.39

* T.= trace.

With an equitable distribution of the rainfall there would be less demand for a crop which can withstand periods of drought.

The column showing monthly extremes in the table above is most striking; only three months have a minimum of more than one-half inch. A glance at the columns of monthly totals will show nearly as striking variations for the seasons. Even this table does not tell the complete story. One must take into consideration the torrential character of the summer rains. A rainfall of 4 inches is not at all uncommon and may occur over a very local area.

These are the moisture conditions especially adapted to the successful growth of prickly pear. Attention is called to this especially because of the apparently well-established idea in the popular mind that the plants will grow with little or no water—i. e., are adapted to any desert condition. On the contrary, they are adapted to grow where the rainfall is considerable but irregularly or periodically distributed. These plants can not grow without water any more than any others, but they can get along for long periods without it on account of the large quantities which they store up in their succulent tissues.

As regards temperature[a] we are concerned with this crop mainly in the minimum. The lowest temperature recorded by the Weather

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[a] The records are all compiled from the United States Weather Bureau records in the city of San Antonio, which are not perfectly satisfactory for our station, because it is not only 8 miles distant, but 79 feet above the ground, and consequently may not represent conditions where the plants grow within several degrees. These records, however, are the only ones available.

Bureau for the San Antonio station is 4° F. in February, 1899, at which time, according to the best information obtainable, pear as well as the huisache (*Acacia farnesiana*) was badly frozen all over southern Texas. This is an unusual temperature and has occurred but once since the establishment of the station. The minimum in 1905, the lowest since these investigations were begun, occurred on February 13, when a temperature of 13° F. was reached. Even this was considered an unusually cold season. At this time the native prickly pear appeared to be near the limit of its perfect endurance. A few plants in the open drooped a little, but no permanent injury was done, as they straightened up again in a short time. The minimum Fahrenheit readings recorded for San Antonio for ten consecutive years, beginning with 1906, are as follows: 24°, 13°, 22°, 19°, 26°, 15°, 19°, 4°, 20°, 18°, 27°, and 11°. But even these temperatures are of short duration. It is seldom that seven days occur during an entire winter with an absolute minimum below 22° F. Winters are rather frequent when this temperature is not reached.

Besides a minimum not lower than something like 12° F. a high average summer temperature is an advantage in the culture of prickly pear. During the ten years ending in 1903 there occurred on an average only four days a year with a maximum over 100° F. One year of this period had twelve days with a maximum above 100° F. and one year's maximum did not reach 100° F. The conditions in this respect are presented in the following table:[a]

TABLE II.—*Maximum, minimum, and mean temperatures at San Antonio, Tex., for a period of eighteen and one-half years, 1888 to 1906, inclusive.*

Month.	Mean.	Maximum.	Minimum.	Month.	Mean.	Maximum.	Minimum.
	°F.	°F.	°F.		°F.	°F.	°F.
January	52	82	6	July	83	106	64
February	55	90	4	August	83	103	57
March	62	97	21	September	78	100	46
April	70	99	35	October	70	97	37
May	75	97	44	November	60	90	22
June	81	103	54	December	55	86	15

PREPARATION OF CUTTINGS OF PRICKLY PEAR.

When these investigations were begun certain conventional formulæ for planting all species of cacti were more or less in vogue. These were found in the practices of horticulturists and in published reports, mainly of French investigators in northern Africa. These practices, briefly summarized, related mainly to propagation from cuttings. It has been the custom among horticulturists, as well as the practice of the growers mentioned above, to prepare the cuttings some time, commonly two weeks, before planting them. In other words, the joints were somewhat wilted before being planted. This practice appears to be necessary under greenhouse conditions, and growers in northern Africa seem to be quite insistent upon the same practice for out-of-door culture. When planted under the humid conditions of the greenhouse, cuttings are much more likely to decay at the surface of the ground unless some of the moisture is evaporated before the cut surface is put in contact with moist earth.

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[a] See also discussions of temperature on page 21.

Prickly pear cuttings do not callous over and produce roots from the cambium and buds as do cuttings from ordinary trees and shrubs, but the cut surface heals over and roots are put forth from the areoles which contain the spines. It is important to bear this in mind in the propagation of the prickly pears. From the greenhouse standpoint it is necessary that the cut surface be thoroughly dried before the cutting is set.

Some attention was paid to this practice when the first plantings were made in the spring of 1905. An attempt was made to prepare the cuttings at least forty-eight hours before they were planted, but it was not always done. Indeed, a considerable part of the planting occurred immediately after the cuttings were prepared. No bad effect was observed from the practice followed, although some of the cuttings were planted during a very wet season. Since that time no attention has been paid to the wilting of the cuttings.

The practice has been to use one-joint cuttings almost entirely for planting, and it is believed that this is the most advantageous, all things considered, for commercial practice. The favorite instrument for making the cuttings has been a hoe straightened out so that the blade is in a straight line with the handle. This is used much as a spade might be used for the same purpose. With this instrument the whole plant is cut up, as nearly as is convenient, into individual joints. Of course it is not always convenient or even possible to strike the union between the joints exactly, but this is approximated as closely as possible. Sometimes the instrument severs one side or the other, but this appears to make little difference, if any.

When the 6 acres of ground were planted in the spring of 1907, it was done with the avowed purpose of performing the work as it was considered the practical farmer or dairyman would carry it on. It was the intention to get as practical a test as possible. The plants after being brought to the field were cut up into single joints mainly by the writer, but the hauling and distributing of the cuttings were done principally by negro and Mexican labor. The handling was done entirely with pitchforks, and the laborers were not cautioned at all about being careful not to injure the stock. As a result, practically every joint planted upon the entire 6 acres had from one to a half dozen fine holes in it. In spite of this, it is certain that at least 99 per cent of the cuttings grew. Indeed, the stand on all portions of the field was practically perfect.

The above experience is cited to show that there is nothing impracticable in our method of rough handling of the cuttings, not as a justification of such handling. The less injury the cuttings receive the better they will grow and the more vigorous plants will they make without doubt; but it is by no means imperative that care to the sacrifice of speed in handling should be indulged in. The cuttings will withstand quite rough treatment and still make good plants, but they should not be unnecessarily bruised or mangled.

As has been stated, single-joint cuttings have been used as a rule. Occasionally when joints were very small two of them have been left attached. The whole plant has been used invariably. All the joints appear to grow equally well, but large, heavy joints two or more years old make much the best plants. Good plants are always obtained from old woody stems, often six or seven years old. These are also much less likely to be bruised and otherwise injured in handling than the younger growth.

The Mexican people who handle very small quantities commonly plant two and a half to three joint cuttings. Their object is to get fruit as early as possible. In the cultivation of their large tame forms they are not concerned with the stock-feed side of the question. They claim to get a good crop of fruit the third year from such cuttings, while it would take five years to secure the same crop from single-joint cuttings. Good crops of fruit have been secured from single-joint cuttings of the native *Opuntia lindheimeri* in three years in southern Texas. The large tame forms of Mexico are much larger plants, and it may consequently take them longer to come into bearing. Indeed, none of them grown from single-joint cuttings alongside of the Texas forms produced fruit in any quantity the third year.

METHOD OF PLANTING.

There are many points connected with the various operations of planting, cultivating, and handling of these plants that have not been fully demonstrated as yet. The best that can be done in connection with some of these processes is to give an account of the methods which have been used in these experiments. It is expected, of course, that these will be improved upon as our experience in growing prickly pear becomes more extensive.

When the cultural work was taken up a 6-foot row was decided upon as the most suitable. The distance between the cuttings in the row has been varied from 2 to 4 feet. Although plantings have been made for the purpose of determining which is the best distance, still it is not possible to make any definite recommendations at the present time any more than to say that close planting appears to be more productive in a general way than the more distant planting. So thoroughly did this appear to be the case in our first experiments that the entire 6 acres planted in the spring of 1907 had cuttings planted 2 feet apart, from center to center, in 6 or 8 foot rows.

It is recommended to those who contemplate the cultivation of this crop for forage in southern Texas that 6-foot rows be adopted and that the cuttings be set 2 feet apart, from center to center, in the row. This will enable one to cultivate one way for two seasons, and the crop if harvested at the end of this time can be cultivated again for the succeeding two seasons, when the second crop is being grown, and so on indefinitely. It will be difficult to get a horse through 6-foot rows after the second year. It is quite possible that further experience will demonstrate that other distances will be more advantageous. It may be that 2 feet apart in the row will bring the plants too close together to produce the maximum yield, or that the red spider will prove less injurious when the plants are grown farther apart. These are questions which will require practice to fully demonstrate. At present it appears that 2 by 6 feet is the proper distance.

The stock planted has been secured from native pastures within a radius of 2 miles from the experiments. The plants cut off at or near the ground have been loaded on wagons with pitchforks. Sometimes the larger plants have been cut up somewhat to facilitate handling. Wagonloads of stock of this kind have been distributed in the field in piles (see Pl. I, fig. 3), which were subsequently prepared for planting by cutting the plants into individual joints with a hoe straightened upon its handle as described elsewhere. The cuttings were then distributed with a pitchfork to the places where they were to grow. Much labor can be saved by a careful distribution of the material so that it need not be carried far.

Several methods of setting the cuttings have been tested. In the earlier plantings some were set on edge in furrows or in holes opened up with a shovel. This hand labor was very expensive and troublesome, and it was soon recognized that it would not do for commercial practice. In the last plantings made the cuttings were not touched by hand at all. A portion of the 6-acre tract planted in 1907 was laid out in rows by running a shallow furrow with a small walking plow. The cuttings were laid against the furrow, the base reaching nearly to the bottom of the depression (Pl. I, fig. 3). Another furrow was then turned in the same direction, throwing dirt over the bases of these joints, covering approximately one-half of them, sometimes more and sometimes less.[a] (Pl. I, fig. 2.) Another portion of the field was simply marked and the joints were laid on the surface of the ground at proper distances in the rows thus laid out. (Pl. I, fig. 4.)

When the ground is very dry, cloddy, or otherwise poorly prepared, it will be advantageous to partially cover the cuttings; but if the ground is well pulverized and in such condition that moisture will be brought to the surface by capillarity, just as good results will be secured by simply placing the cuttings on their sides in firm contact with the ground. Indeed, in the first plantings better plants were secured in this way than when the joints were planted on edge.

There is good reason for this. Attention has been called to the fact that roots spring from the areoles or cushions of spines and spicules distributed regularly over the surface of the stems (joints). This statement is equally true of the new growth. It always springs from these areoles, but these spaces are always more numerous around the edges of the disk-like cuttings. When the cuttings are laid flat on the ground it is but a short time before unequal evaporation from the two surfaces causes them to dish slightly. This will leave the areoles in the center of the lower surface in contact with the ground. They will form roots in a very short time. From any portion of the slightly upturned edge of the joint new growth may take place. In the case of joints buried 6 inches or more by the plow, or otherwise, the surface for new growth is reduced at least by one-half and the base or foundation of the plant is also reduced, or, more properly, is much smaller than when the cutting is laid flat and the whole edge is in position to send out new growth.

It is very fortunate that the plants grow readily in this position, for planting in this way greatly reduces the labor involved. Usually all that is necessary is to drop the cutting into place from the fork. At other times it may be necessary to press it down with the foot or a slight pressure of the fork after it is in place. It should be borne in mind that the cuttings should be in contact with the ground. If they are held away from it an inch or so by clods, or even by the long, stout spines found in some of the varieties, the chances of their becoming established are greatly reduced. Indeed, if none of the areoles is in actual contact with moist earth the cuttings will not grow.

TIME OF YEAR TO PLANT.

There are indeed few, if any, crops which have such a range of adaptability as regards the time at which they may be planted. Beginning with February, 1905, plantings were made between the first and tenth of each calendar month, except August, for the next twelve months, to determine, if possible, the most favorable season. No plantings were made in August because it was excessively dry and hot, similar to July, when cuttings failed to grow. All other plantings grew as well at one season of the year as another. All of the plantings, except a part of those made in February, were upon uncultivated ground, the joints being placed in a furrow and partially covered, as described elsewhere. This feature is again a decided advantage, for it enables the farmer to plant this crop at almost any time of the year. In other words, it can be done during a season when other farm operations are not pressing. There is little doubt that cuttings will grow even in July and August, provided those months happen to be sufficiently moist.

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[a] Care must be taken not to cover the joints, for they will almost invariably rot if this is done.

RENEWAL OF PLANTATION.

Little is known about the length of time during which a plantation will grow when repeatedly harvested in a systematic manner. No reliable data are available. The nearest approach is in the case of the planting made by Mr. D. M. Poor (Pl. II, fig. 3). This plantation, consisting of two-thirds of an acre, was established by Mr. Poor about 1885. He laid off the ground in rows 2 feet apart, with an ordinary two-horse plow, in land which had been cleared of brush but never broken. Native pear was chopped up into one or two joint cuttings, distributed in the furrows, and subsequently partly covered with another furrow. The area has been used more or less for twenty years, but it has never been cultivated. It has never been harvested closely and certainly never systematically.

A plantation well established and cultivated is good for an indefinite period, say fifteen or twenty years. Should plants in various portions of the field die for some reason, it is a very simple matter to establish new ones when the crop is on the ground. All that is necessary is to cut off a joint and put it in the proper place flat on the ground.

CULTIVATION.

Upon the subject of cultivation little need be said. The ground to receive the cuttings should be well and deeply prepared, and subsequent cultivation should probably be shallow, for the plants are shallow rooted. There are no cultivators known which are exactly suited to this crop. In the experimental work described in these pages an ordinary one-horse spike-tooth cultivator has been employed. The objection to this implement is that the framework is too large, interfering with the projecting branches of the plant, and also it is not easily regulated as to depth. Some tool of the nature of a one-horse sweep which could be regulated so as not to go into the ground much more than 2 inches would be more serviceable. In the experimental plantation it has been the endeavor to cultivate just enough to keep down the weeds and prevent the ground from baking. To keep down the weeds thoroughly it has been necessary to go through the plantation occasionally with a hoe, knocking down such stray weeds as the cultivator did not reach.

TIME OF HARVESTING.

It is not the purpose of this paper to attempt to say how often it will be most profitable to harvest crops of prickly pear from established cultivated plantations. Experience in this matter, as in many others, has been too brief. All that will be attempted at the present time is to state what can be done with one definite plan of cropping.

Prickly pear has been considered a slow-growing plant, and indeed it is a slow grower under natural conditions, where it is obliged to compete with hardy grasses and other vegetation. In a previous publication[a] the opinion has been expressed that it will take five years to produce a crop on uncultivated lands in the vicinity of Eagle Pass, Tex., while in the same publication estimates made by ranchers give the period as from two to three years. There appears to be no reason at present for changing the first estimate for uncultivated lands, while it has been demonstrated that a crop can be profitably harvested in two years in cultivated plantations. Whether a proportionately greater yield can be secured by allowing the plants to grow three or four years has not been determined, but a paying crop can be secured at the end of the second year, and probably can be utilized at the end of eighteen months to good advantage if plantings are made in February or March. The first harvesting done upon the experimental tract was two years after planting. As shown in another place, there was at that time more than sufficient roughage upon an acre to feed two cows for one year.

But little fruit will be produced the first two years, but quite a large crop will usually be secured the third year.

METHOD OF HARVESTING.

The different methods of preparing prickly pear for the use of stock have been sufficiently discussed in other publications[b] and need not be repeated here.

In the singeing process economy depends largely upon the disposition of the plants. In the case of natural growth much time is consumed in walking from one plant to another, because the plants are usually scattered over the field. Systematic planting economizes both time and fuel.

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[a] Bulletin No. 74, Bureau of Plant Industry, "The Prickly Pear and Other Cacti as Food for Stock," 1905.

[b] Especially in Bulletin No. 74 of the Bureau of Plant Industry, pp. 12–20.

In the harvesting which has been done thus far upon the experimental plantations the torch has been used on standing plants, and cattle have then been turned on to graze them (Pl. II, figs. 1 and 2). Others have been cut down and hauled out of the field. This work was done in the spring of 1907. In the autumn of the same season little, if any, difference could be noticed between the growth made by the plants harvested by the two methods. Those plants grazed by the cattle, however, were left in a very ragged condition and consequently did not present so good an appearance. So far as growth is concerned, however, it must be admitted that grazed pear was nearly, if not quite, as good as that which was cut down and hauled off.

There are several methods of harvesting open to the grower, two of which have been mentioned here. Besides these methods the plants may be cut down before singeing, and, if desired, two rows may be cut into one center. The plants as they lie on the ground may then be singed. Again the plants may be singed as they stand in the row and then cut down, the cattle being allowed to graze them where they fall. It is quite possible that the best method is the last mentioned.

The singeing is done by pointing the blast flame downward in the center of the plant, because in this way the maximum surface is covered at one time by the flame. Afterwards the outer joints will be touched by the blast. These processes can easily be regulated so as to interfere but very little with the stump which is to be left standing. After the singeing the plants can be cut down and grazed where they fall. This will avoid leaving the stems partially chewed and macerated, in which condition they are more likely to decay and result in injury to subsequent growth. Of course the plants can be cut down before singeing, but the burning can not be done so advantageously after the plants are felled. When standing, both sides of the joints, which are in a more or less upright position, can be easily reached with the flame, while when felled the lower side in contact with the ground can not be so easily singed. The two most important requirements are economy of time and fuel and protection of the stumps which are to produce future growth. These requirements should be borne in mind constantly. Any process which economizes time and fuel and does not injure the stem is the one to use. It seems to the writer that singeing and then cutting the plants down to be grazed where they fall accomplishes this result best.

In some instances in the experimental investigations the harvesting has been close, leaving nothing of the old plant but the original cutting. In other cases the harvesting has been done so as to leave all the joints directly attached to the original cutting. The latter plan leaves a stump of two to four joints. If the plant was established from a cutting laid on the surface of the ground, a large base and a good surface for future growth to spring from will be secured. There is no doubt that a large stump of this kind is an advantage; neither is there much doubt that these old stumps will produce a much heavier yield for the second biennial crop than is produced from the freshly established cuttings for the first crop. A considerably heavier growth was secured during the season of 1907 from plants having a stump of three or four joints from which to develop.

VARIETIES TO PLANT.

In the southern Texas region there are several native varieties of prickly pear, but in each locality there is usually one variety which predominates. The very fact that it does predominate is fairly good proof of its superior value for that locality.

In the vicinity of San Antonio the predominating variety is the typical form of *Opuntia lindheimeri* Englm., and this is the one which is considered the best of all the forms for cultivation in this immediate locality. Before any plantings were made upon the experimental tract a careful examination was made of the varieties in the neighborhood, and this one selected is the most promising. Subsequent results—for other varieties were also planted for comparison—confirmed the first judgment. There is no question that this is the most valuable of all the forms and species used. It has prominent and formidable spines, which turn white toward the end of the first season's growth, and abundant light golden spicules.[a] Another native variety with a trifle darker color, less formidable spines, and brown spicules has also made nearly as good growth and a much heavier crop of fruit. This may prove valuable. From 150 to 200 varieties have been planted. On the whole, none is to be recommended above the spiny native just mentioned. Some of the varieties planted, however, have characters which are decidedly advantageous.

One cultivated spiny form secured farther south is very promising for breeding purposes. It has withstood the climate the first two winters very well, but should another winter like 1904–5 occur it is certain to suffer badly, for it was cut back very severely then in the locality where secured. The spines on this one are not as formidable as on the native form that is being grown, and the spicules are almost entirely absent on the joints. This variety has made a growth at the rate of not less than 55 tons to the acre per annum during the past two years.

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[a] See Bulletin No. 91, Bureau of Animal Industry, 1906, pp. 9–11, for further notes on this species.

The prospective planter should study the plants in his locality carefully before planting. He should select that form which makes the largest and most rapid, clean growth, and from that variety he should choose the most healthy plants. Selection should be made first for vigor and second with reference to the habit of the plant. In southern Texas those forms growing most erect are to be preferred. In no case should a low, prostrate, or sprangling form be used. As compact a growth as possible is desirable on account of the greater ease with which such forms are singed and cultivated. An open-branching, low habit of growth renders the operation of cultivation very difficult on account of the interference of the branches with the animals and the machinery used in cultivation.

COST OF PLANTING.

During the spring of 1907 a careful record was kept of the cost of planting 6 acres of prickly pear upon the experimental plots. Owing to the requirements of the farm, men could not be employed regularly for full days on the planting and preparation of the ground, but so far as the value of the record goes it is considered that nothing is lost, for the time has been kept in hours for man and team.

The ground selected had never been plowed. It was in native grass, closely pastured for several years, and had been grubbed nearly clean of mesquite and other brush years ago. The greater part of the plowing and harrowing was done at odd times between the 1st of January and the 1st of March. The season being very dry considerable difficulty was experienced in getting the soil well pulverized, and even the plowing was done with much difficulty.

The stock used for planting was secured from various local sources, ranging from close by to 2 miles distant. The greater part of the stock, although it was practically all of the same variety, was hauled from a neighboring ranch 2 miles away. Some was cut from a pasture about half a mile distant, and about four loads from a smaller experimental tract planted two years ago contiguous to the present field.

The time employed in the various planting operations, exclusive of the preparation of the ground (plowing and harrowing), was as follows:

	Hours.
One man and team hauling stock (6 acres)	85
One man and team marking (6 acres) and covering (3 acres)	14
One man distributing cuttings (6 acres)	54

The laborers used in hauling were negroes and Mexicans, and the time was not employed to good advantage. It will be seen from the above statement that the heaviest item of expense was for hauling the stock for planting, which ought to have been done, even under the disadvantages of distance, much cheaper.

Assuming the value of a man and a team at $3 and a man at $1 a day of ten hours, the cost of planting an acre after the ground is prepared is a little less than $6. If it is assumed that the value of the preparation for planting is $3 an acre, then it costs about $9 an acre to get the cuttings planted. With good labor advantageously employed this expense could doubtless be reduced to $6 or $7 an acre, but even at $9 the operation is not expensive when it is considered that a plantation is probably good for fifteen or twenty years and that subsequent planting or establishing plants is a simple matter when the material is on the ground and all that is necessary to establish a new plant is to lay a joint in firm contact with the soil.

SPINELESS COMPARED WITH SPINY SPECIES.

Much emphasis has been placed of late, especially in popular writings, upon the great advantages of spineless prickly pears. The spines of these plants leave an unpleasant memory. They are difficult to handle, and the novice usually can not conceive how the plants can be utilized at all on account of their formidable armament. It naturally follows that if spineless forms can be substituted the last objection to them has been removed. They could then be handled with bare hands, and eaten as they grow by all kinds of live stock. So firmly is the "spineless cactus" idea established in the public mind that much talk has been made about establishing such forms, even on the deserts, supplanting the native forms and producing an abundance of forage for live stock—this to be utilized without the singeing process to which the native spiny forms must be subjected.

While such ideas are very interesting and attractive, there are many practical considerations which must be taken into account. Of course, the experience of the writer is as yet meager, these experiments having been carried on only about four years. However, observation, together with three or four years' experimental evidence, while not conclusive, points strongly to certain conclusions which are not at all favorable to spineless forms for southern Texas, for the immediate future at least.

Thus far no spineless forms have been found which are hardy under the conditions existing at San Antonio. The writer has secured ten or twelve spineless forms from Mexico, and the Office of Seed and Plant Introduction of the Bureau of Plant Industry has imported for investigations as many more from Hawaii, southern Europe, and northern Africa, all of which have been planted and well cared for. All that are left of these spineless forms at the present time are such individual plants as have been protected during the winter. There are a few nearly spineless forms here and there in southern Texas, but so far as has been observed none of them are quite hardy. They live through one or two winters all right, but may be frozen down badly the third winter. The nearest approach to hardiness that has been seen is in the city of Laredo, Tex. There are here a few plants (nearly spineless) which often pass the winter uninjured, but they were frozen to such an extent in February, 1904, that not less than one-half of the joints broke off. Even these are not hardy upon the plantation at San Antonio and probably would suffer nearly every winter at Laredo were the plants there not protected by surrounding buildings.

Lack of hardiness renders the spineless forms of no economic value at the present time in southern Texas. If they can not withstand the winter temperature it is of course useless to plant them. But while this is true it is not at all improbable that these smooth forms may in time become very important and possibly entirely supplant in culture those forms which are now being grown. The bringing about of such a condition is, however, a long and tedious process which will involve years of breeding in which the farmer can usually take little or no part. Work along this line is now being conducted for the benefit and use of the future, but *present results must be secured from spiny natives.* Of course, in experimental work sight is not lost of the fact that economic conditions may change in the future so that it will be advisable to have spineless forms, but the whole question is one of production. If spineless forms which are hardy and which will produce more feed than spiny species which are now being grown can be evolved they will be valuable in proportion to the excess of feed which they will produce. This is as yet a purely experimental field, but the spiny native varieties have been proved to be valuable.

Aside from lack of hardiness, the spineless prickly pears have other disadvantages. Wherever grown they have to be fenced. It will be obviously impossible to grow them in uncultivated pastures, even in regions where they are hardy, for they would be grazed too closely, if not exterminated in a very short while. Fences are expensive. Unless the area planted to these forms were very large, which it could not be for some time, a rabbit-proof fence would be required. This sort of fence has been found necessary in order to protect the varietal plantings made by the Bureau of Plant Industry at San Antonio. Spineless forms would be severely injured by rabbits, gophers, and rats. The latter often do considerable injury to the spiny native plants, but the spineless forms would suffer very severely. A planting of about a hundred cuttings of imported varieties, not all spineless, was completely destroyed in a fortnight by rabbits in southern Arizona two years ago. When a large acreage is planted the danger from these pests will not, of course, be so seriously felt, but it will be many years before any extended plantings of spineless forms can be made. There is not enough stock of spineless prickly pears in this country at the present time to plant 5 acres if it were all gathered into one place.

A plantation of spineless prickly pear would not only have to be fenced, but stock could not be allowed to enter the field at any time of the year, for they would trample over the entire field, knocking down plants hither and yon and causing an unwarranted waste. All of the crop would have to be harvested, loaded on wagons, and hauled to another lot to be fed. Remembering that 100 pounds a day will be eaten by an average cow, it will be seen that this procedure will mean considerable expense. In a 100-cow dairy it will mean the moving of 5 tons of material for feed each day, besides the removal of the manure. On the other hand, the spiny forms, singed and fed where they stand, obviate this expensive handling and cause the manure for 100 cows to be distributed each day on about one-fifteenth of an acre—by no means a small item in maintaining fertility. With spiny forms the number of plants fed or grazed each day is absolutely within the control of the rancher, even though stock is allowed in the field all of the time.

So far as southern Texas is concerned the advantages of the spineless and spiny prickly pears concerning which we have any knowledge may be summed up as follows:

Advantages of spiny native forms.	*Advantages of spineless forms.*
1. They are hardy.	1. They do not require singeing.
2. They do not require fencing.	
3. They are injured but little by wild animals.	
4. They require a minimum of handling.	
5. They accomplish the distribution of the manure during the day.	

QUANTITY OF FEED PRODUCED BY PRICKLY PEARS.

Our knowledge of the yield of prickly pear, either under natural or cultivated conditions, is as yet quite imperfect, and the statements made herein with reference to yields are made with such reservation as is consistent with the meagerness of the evidence. However, it is believed that all computations in whatever manner made are exceedingly conservative, and underestimate rather than overestimate in every case what may be secured from a cultivated crop of prickly pears.

The first plantings at San Antonio, and, indeed, the first attempt ever made in this country to cultivate this plant as food for stock so far as the writer is aware, occurred in February, 1905. A plot of ground 416 feet long and 208 feet wide (2 acres) was secured under lease the preceding winter. Half of this area was plowed and put in a good state of cultivation, the other half being left in the condition in which it was found, i. e., in native sod, with all brush removed. One half of the cultivated portion (one-half acre) was reserved for varietal plantings and the other half was planted to three or four varieties of native species, the typical *Opuntia lindheimeri* predominating over all others. The whole area was laid off into 6-foot rows, numbered 1 to 69, and all plantings have been made on this plan, variation being made in the distance apart of the plantings in the row only.

Early in March, 1907, when the plantation was 2 years old, the first harvesting was made. No weights were obtained except on a small scale—too small, in fact, to make a reliable record, and consequently need not be reported upon here. In one instance 75 head of stock were turned in to graze off two rows which had been singed. As nearly as could be estimated this number of cows got from this small area a full day's ration of roughage. There were some young cows among them, and some which did not eat pear as freely as they should, but nevertheless they had been fed prickly pear regularly all the winter and were still receiving it daily. Accepting the above as the measure of the biennial production of forage of this plant under cultivation, it will readily be appreciated that at this rate 2 acres of this crop would, roughly, supply roughage for 75 cows for one month, and 25 acres would, roughly, supply their needs for one year, but as it took two years to grow this crop, on this basis it would require only 50 acres to furnish rough feed for 75 cows continuously. It is recognized that this is a very crude and imperfect estimate of production, but it is, nevertheless, instructive when taken in connection with what the eye can see of the 2-year-old crop shown in Plate II, figure 4. In order to put the matter very conservatively, suppose this area was increased 50 per cent; this would mean that 75 acres would furnish 75 cows with continuous roughage. This is still a production equaled by that of few areas in the country. This quantity was produced during one very favorable and one very unfavorable season and probably represents about the average crop.

More definite data upon production were secured early in October, 1907, when the plantation was 31 months old. At this time two rows were selected near the east side of the native plantings on cultivated ground because they were thought to be typical of the half acre of the cultivated native *Opuntia lindheimeri*. These rows were harvested down to the original cutting and weighed. These two rows, numbered 20 and 21 in the records, yielded 8,518 pounds. Rows 35 and 36 were then harvested, and weighed in the same manner. Row 36 was considered the poorest in the area. This was in part due to its being in close proximity to uncultivated ground and in lesser part to the ravages of the red spider. These rows were taken in order to be certain not to overestimate the production. These two rows yielded 7,269 pounds. On the four rows, therefore, there were produced 15,787 pounds. The area occupied by them measures three twenty-sixths of an acre. The yield to the acre, consequently, was 136,820 pounds, or 68⅖ tons. On account of the time of the year at which the measurements were made it is rather difficult to reduce this thirty-one months' growth into yearly terms, but if it is assumed that three years' growth was secured an average yearly production of 22⅘ tons of green, succulent forage is shown.

This estimate of the average growth per annum of 22⅘ tons is certainly conservative. It is evident that the growing season is not closed the 1st of October, but, on the other hand, that a very decided increase will occur between that time and February. Again, the measurements were made at the close of a long dry season. It is quite certain that the growth for the remaining five months, together with the water absorption of the humid winter season, would be expressed by tons to the acre. Besides this growth of plant body, there was produced during the third growing season between 4 and 5 tons of fruit to the acre. This fruit is greatly relished by horses, cattle, sheep, and swine, and is harvested by them without assistance and without injury to the plants.

In feeding dairy cattle[a] at San Antonio it was found that a complete roughage ration of prickly pear consisted of about 140 pounds for each cow daily. In feeding steers for market at Encinal, Tex., an average of about 75 pounds was eaten daily by each steer. These figures would indicate that 100 pounds is about what the average animal will eat in a day. But the yields previously stated show that sufficient roughage is grown here on an acre for about one and one-fourth animals.

Any way it is figured, roughage of prickly pear for one mature bovine animal on an acre seems to be a very conservative estimate.

CULTIVATION AND NONCULTIVATION.

At the same time that estimates were made of the rate of growth on cultivated ground rows 37 and 38 were harvested. These were grown without cultivation. As stated elsewhere, a furrow was opened in the native sod, the joints laid against the land side, and the dirt pulled back over their bases. The growth of pear on these two rows in thirty-one months weighed 980 pounds. This is at the rate of 8.49 tons to the acre. Reducing this to terms of annual growth in the same manner as was done in the other case, we have 2.83 tons to represent the growth per annum upon uncultivated ground: in other words, eight times as much forage was produced under cultivation. (See Pl. I, fig. 1.)

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[a] Bulletin No. 91, Bureau of Animal Industry, 1906.

The method of planting insured the rooting of the cuttings practically the same upon uncultivated as upon cultivated land. Practically every cutting in either situation rooted and grew through the period specified.

It should be noted that the plantation is under fence. The prickly pear upon the uncultivated ground, therefore, had to compete with its full complement of grass growth. It would have made a greater gain if the grasses were grazed off, as they commonly are in the native pastures of the region. The figures showing the relation of the production under the two conditions are consequently not comparable with what would take place in pasture-grown pear. Indeed, the growth in Mr. Sinclair's pastures just outside of our fence was very much greater than that upon our uncultivated area. This furnishes a very strong suggestion as to the cause of the increase of prickly pear in some sections of southern Texas since its occupation and settlement. Formerly, when grasses were not grazed so closely, they were stronger competitors of the prickly pears than they are now and were able to keep it in check. Overgrazing, coupled with the prevention of fires, is doubtless responsible for the excessive growth of prickly pear in some sections of the region. On the other hand, the rapid increase of mesquite and other brush tends to check the growth of the pear, for it does not thrive in the shade.

SOME EFFECTS OF CULTIVATION.

During the year 1907 the drought from June to October 1 was much more pronounced than the average for this section. The prickly pear in the pastures surrounding the experimental plantings, as a consequence, was suffering considerably by the 1st of October. Nearly all of it was somewhat shriveled, and in a few instances the color had begun to change, showing the beginning of interference with metabolism. Upon the cultivated area, on the contrary, the long period with little precipitation had no apparent effect. All plants were thrifty and vigorous. It is believed that no particular injury would have resulted if no rain had occurred for another three months.

The effect of cultivation upon the development of spines is naturally of some interest, and since the writer has often been questioned regarding the comparative spininess of cultivated and uncultivated plants, a few remarks upon the subject are made, with, however, no attempt at any generalization. In the case of the typical form of *Opuntia lindheimeri*, which is being grown in the experiments, there is a decided increase in spininess under cultivation. Indeed, the entire plant looks somewhat different when cultivated; that is, a plant under favorable conditions is just as different from a plant growing under unfavorable conditions in this species as in the common cultivated crops. A comparison of Plate II, figure 3, with Plate II, figure 4, will tell better than words what the differences are. The first is a view of the Poor plantation, which, although planted originally, is in a practically native condition, for it was never cultivated. It will be readily seen that the spines are fewer by several fold upon the uncultivated plants. No quantitative measurements have ever been made, and consequently only general statements are possible at this time.

USES OF THE CROP.

A more or less complete discussion of the uses to which prickly pear is put will be found in Bulletin No. 74 of this series, and a further discussion of the value of the crop is contained in Bulletin No. 91 of the Bureau of Animal Industry of this Department.

The crop appears especially adapted to dairy purposes because of the comparative ease with which the ration can be balanced by the addition of concentrates, which are used with all roughage in this region. The succulence appears to be a decided advantage, and of course can be obtained at any time of the year if the plants are grazed where standing or are harvested as fed. The importance of this can not be overestimated, for it applies to all seasons of the year, and oftentimes green feed for dairy cattle is as difficult to secure in the summer as in the winter. There is an impression in some sections that this feed can not be used after the new growth starts in the spring, but this is entirely disproved by the practices of several ranchers who have used it at all seasons of the year with good results. Of course there is a period during which the young growth will not be eaten on account of its being distasteful to animals,[a] and this growth will therefore be wasted at that time, but there is no season of the year when pear will not be readily eaten, especially if other feeds are short or dry.

It is very probable that the crop can also be used successfully for the production of baby beef, as has been suggested by Mr. Sinclair, who has fed pear with as great success as anyone in southern Texas. This region has been a favorite breeding ground for many years, and much beef is constantly prepared for market, a large part of which is accomplished by the use of prickly pear at some stage of its growth. The great drawback in any beef production—especially in the production of baby beef—is a lack of continuity of feed. An abundance of pasture is to be had in some seasons, but in other seasons it is too short for the maintenance of a steady rapid growth. A roughage like this, therefore, which can be utilized at any season and is a sure crop, fills a gap not filled by any other.

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[a] See Bulletin No. 91, Bureau of Animal Industry, 1906, p. 17.

Prickly pear roughage is relished by nearly all kinds of live stock. No case is known of horses being fed on it, but other classes of stock eat it readily. Cattle, sheep, goats, and swine relish it, and even chickens utilize it when it is chopped for them. Hogs will eat even stumps and heavy joints that cattle leave.

In short, it can be said that prickly pear is of vastly more importance in southern Texas than is ordinarily appreciated. A crop which will produce twenty-odd tons of roughage to the acre per annum with a degree of certainty not attained by any other, and this readily eaten by all classes of live stock, is not to be disregarded as an important farm crop even if it has been looked upon as something of a nuisance in the past.

PRICKLY PEAR COMPARED WITH SORGHUM.

Upon another page it has been shown that 22⅘ tons of prickly pear can be grown each year upon the gravelly-black-waxy soils of the San Antonio region of Texas. The main hay crop upon the ranch where the experiments are conducted has always been sorghum, and since the experiments were started this has been placed in a silo. In the season of 1906 about 1 ton of silage was secured to the acre, and in 1907 about 2½ tons. These are estimates made in the silo.

In feeding tests upon the ranch in 1905 it was found that 6 pounds of prickly pear produced the same results in feeding dairy cattle as 1 pound of dry sorghum hay.[a] If 1 ton of hay is assumed to be equivalent in feeding value to 3 tons of silage, then the hay production from sorghum has been on an average for the past two years only seven-twelfths of a ton to the acre per annum. This seven-twelfths of a ton of hay, assuming the relative value of sorghum hay to prickly pear to be as 6 to 1, is equivalent to only 3½ tons of pear. In other words, prickly pear has produced more than six times as much roughage during the past two years as sorghum. Of course, the yield of sorghum mentioned here is abnormally small, but seasons occur every now and then in this region when crops are short.

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[a] See Bulletin No. 91, Bureau of Animal Industry, 1906, p. 4.

and while they may be assumed to be at the lowest point of production during these two years it is against these years of shortage that it is necessary to provide.

ENEMIES OF THE PRICKLY PEAR.

There are many fungus and insect enemies of the prickly pear, but only one insect and one fungus need be considered in this place because the others have not thus far given cause for any apprehension.

The black-spot fungus (*Perisporium wrightii*) is first found as a soft, brownish area, usually more or less circular, on any portion of the joint. This soon becomes black and rotten, and later dries up when the ascogenous bodies appear upon the epidermis. Often there may be a dozen of these spots on a single joint, and these are approximately one-half to 1 inch in diameter usually and extend clear through the joint. When but one or two occur the joint may recover, the tissue healing up around the diseased portion, when the dried diseased tissue falls out, leaving a notch or a clear circular opening through the joint. When the diseased spots are numerous, the plants are very much impoverished and the joints often drop off, the healing in this case occurring at the union between them.

Fortunately this disease appears less prevalent upon plants under cultivation. In February, 1905, when the first plantings were made, one row, 208 feet long, was planted to very badly diseased pear in order to study the behavior of the disease. There are at present some diseased plants upon this row, and many of the cuttings failed to grow, but the vast majority of the plants have overcome the disease quite perfectly. It is much more common on some varieties than on others, and the badly diseased material which was planted was discovered later to be of a different variety from that which it is recommended should be planted in the vicinity San Antonio. The typical form of *Opuntia lindheimeri* which is recommended is much less subject to this disease than some of the other native forms. It is a common disease in many species of prickly pear throughout the pear region from Texas to the city of Mexico.

The only practical remedy is to feed the diseased plants and propagate from healthy stock only. At the present time it looks as though this method of handling would reduce the injury to a minimum. The cultivated area referred to, except where diseased pear was planted, is quite free from disease now. The stock was carefully selected, however, and there appears to be no disease on either the cultivated or uncultivated areas.

The red spider (*Tetranychus opuntiae*), on the contrary, is more serious upon cultivated than upon uncultivated land. These minute animals work around the areoles of spines and spicules first and gradually cover the entire surface of the joint. After they have worked on the pear, a yellowish or brownish dead callus forms over the entire surface. This cracks in places and there is often a considerable exudation of mucilage, which, although white at first, finally turns black. The plants are very much disfigured by this mite, but it can not be stated at present just how much real injury is done, for no plants have been observed which have been killed by it.

It may be difficult for the uninitiated to recognize what the trouble with the plants really is, but after seeing it or having it pointed out it can not be overlooked, for the diseased condition is very characteristic. It is not so easy to find the mites, however, because they are very small and at times nearly, if not quite, absent.

Just what their habits are during the season has not been worked out. It is certain that they were abundant in March, 1907, and less abundant in the autumn of the same year.

The Mexicans are very familiar with this diseased condition, but so far as known have not interpreted the cause. Attention has been called to it several times by Mexican ranchers, who deplored its presence and expressed the opinion that it might in time entirely destroy such forms as nopal amarillo, naranchado, chaveño, and certain forms of joconoxtle. While these fears express extreme views, there is no doubt that the red spider is a pest to be reckoned with. However, in Mexico, as in the United States, the greatest injury is done when plants are close together or growing intermingled with other shrubbery. This crowding together of the plants is probably the cause of the large numbers of mites which developed in our cultivated experimental area.

Experience is altogether too limited yet to permit much, if anything, to be said with any certainty about this injurious insect. A few observations, however, may be of interest. These, concisely tabulated, are as follows:

(1) The disease occasioned by the red spider has long been known, but its cause has only recently been determined.

(2) It has never been alarmingly abundant upon the uncultivated pear in southern Texas.

(3) At the end of the second year a few red spiders appeared in our plantation.

(4) During the third season these mites multiplied rapidly and did considerable injury to the older plantings.

(5) All plants harvested in any manner whatsoever in the spring of 1907 were uninjured by the red spider during the season, although some of them were badly infested when harvested.

(6) No red spiders were found during the season on plantings made in the spring of 1907.

(7) The red spider has been abundant upon thick plantings only, and no injury has been done any of the plants except the natives thus far.

(8) Red spiders are injurious only part of the year. In 1907 they were abundant in March.

(9) Heavy rain washes the red spiders off and they do not appear to regain possession for some time, but just how long has not been determined.

(10) Prickly pear having red spiders on it is eaten as readily by live stock as that which is not affected.

The above observations indicate that the red spider can be kept in check by feeding such areas as are affected as they appear. The fact that the crowding together of the plants seems to increase the spread of the red spiders and the injury done may influence the method of planting.

Another malady which is of very common occurrence can probably be discussed here as well as elsewhere, because it is commonly looked upon as a disease. This occurs some time in the spring of every year at San Antonio. It is a condition in which the new joints of the plant drop off when about half grown. The recovery from its effects is very rapid, but of course the growth which drops off is lost.

To illustrate the extent of this malady, a single case in which a quantitative estimate was made can be mentioned. About the middle of May, 1905, a large plant harvested during the winter of 1903-4 had just recovered from the effects of this malady. It had made a splendid growth the previous season and had started vigorously again when the joints began to drop off. At the time referred to most of the fallen joints were completely dried. Fifty-two of them were lying at the base of the plant, while eleven more were partially injured. In spite of this, the plant had completely recovered and was then supporting, besides the eleven somewhat injured joints still clinging to it, fifty-eight perfectly sound and normal ones. What proportion of the latter started after the falling of the first crop of joints can not be stated, but probably nearly all of them. This was a large, vigorous plant (second growth) from an old stump harvested several times, and probably represents an extreme case, but it is not uncommon for one-half to two-thirds of the first crop of joints to be lost in this way at San Antonio.

The exact cause of this particular phenomenon has not been demonstrated, but it appears to be due to neither fungous nor insect enemy, but, on the contrary, to be purely climatic. Observations seem to indicate that the falling of the joints takes place some time after a cold and usually a moist spell of weather which occurs when the joints are about half grown and while they are thin and leathery, before they have begun to swell out into the normal shape of the mature joint.

In 1907 this malady was at its height about April 27. At this time nearly all the season's growth on many species was destroyed, and in some none remained. In others about half fell off, while a very few varieties were uninjured. The native *Opuntia lindheimeri* was not much affected; possibly one-eighth of its joints were injured, but not more than this. All varieties recovered speedily, putting out new joints in a short time. No injury was done to the previous year's growth.

While often a large part of the growth of a month or so in the spring is lost in this way, no apprehension is felt regarding the matter in respect to the yield. In fact, the yields which are reported elsewhere in this paper have been produced each year in spite of this malady.

SUMMARY.

These experiments in planting prickly pear as a farm crop have been conducted in a region having a rainfall varying from 15$\frac{9}{10}$ inches to 40$\frac{1}{2}$ inches a year, the average for the past eighteen years being 28$\frac{3}{5}$ inches, but this rainfall is very unevenly distributed.

The absolute minimum temperature for the locality is 4° F., but this is exceptionally low, having occurred but once in eighteen years. During the ten years ended in 1903 there was only one year which had seven days with a minimum below 22° F., two years had none lower than 22° F., while the others had from one to six days during the year with a minimum temperature lower than 22° F.

The plants are most advantageously grown from single-joint cuttings, which are easily prepared by cutting up all of a full-grown plant into single joints with a spud or spade.

Plants should be established about 2 feet apart in 6-foot rows.

When the ground is moist and well prepared, cuttings can be distributed on the surface of the ground. When these conditions are not met the cuttings should be placed in a furrow and partially covered with another furrow. With care a sulky cultivator can be used for covering the joints.

Planting may be done at any time of the year except during the hottest and driest part of summer.

Cultivation should be shallow and sufficiently frequent to keep down weeds and prevent excessive baking of the soil.

Plants set in February can be harvested at any time of the year after twenty to twenty-four months.

It is believed that it will be found advantageous in harvesting to singe the standing plants and then cut them down to be grazed. However, good results have been obtained without cutting. It is possible to singe after cutting, but it is a little more difficult and will probably be attended with more waste.

It will be advantageous in harvesting to leave a stump of two to four joints rather than to harvest too closely.

Those forms which are most vigorous and most free from disease should be selected for stock to plant. In the vicinity of San Antonio this is the typical form of *Opuntia lindheimeri.*

The experimental plantation cost nearly $9 an acre, including all expenses, beginning with the breaking of the raw prairie and ending with the cuttings properly placed. With good labor and proper management this expense, it is believed, could be reduced to $6 or $7 an acre. Even $9 per acre is low for a plantation that does not require renewing for fifteen or twenty years.

The spineless forms thus far grown (about twenty varieties) are practically useless under present conditions in Texas except for breeding purposes.

A conservative estimate of the annual production of prickly pear under cultivation is 22⅘ tons, or enough roughage for one bovine animal for a year from each acre of ground. This is to be harvested biennially.

Cattle, sheep, goats, swine, and even chickens will eat the crop readily at any time of the year.

Eight times as much growth of prickly pear has been secured under cultivation as was obtained without cultivation in ungrazed pastures.

More than six times as much roughage (actual feeding value) has been secured during the past two years from prickly pear as from sorghum.

One fungous and one insect enemy of prickly pear of some importance are found, both of which may be controlled either by selection of stock or by methods of harvesting, or by both combined.

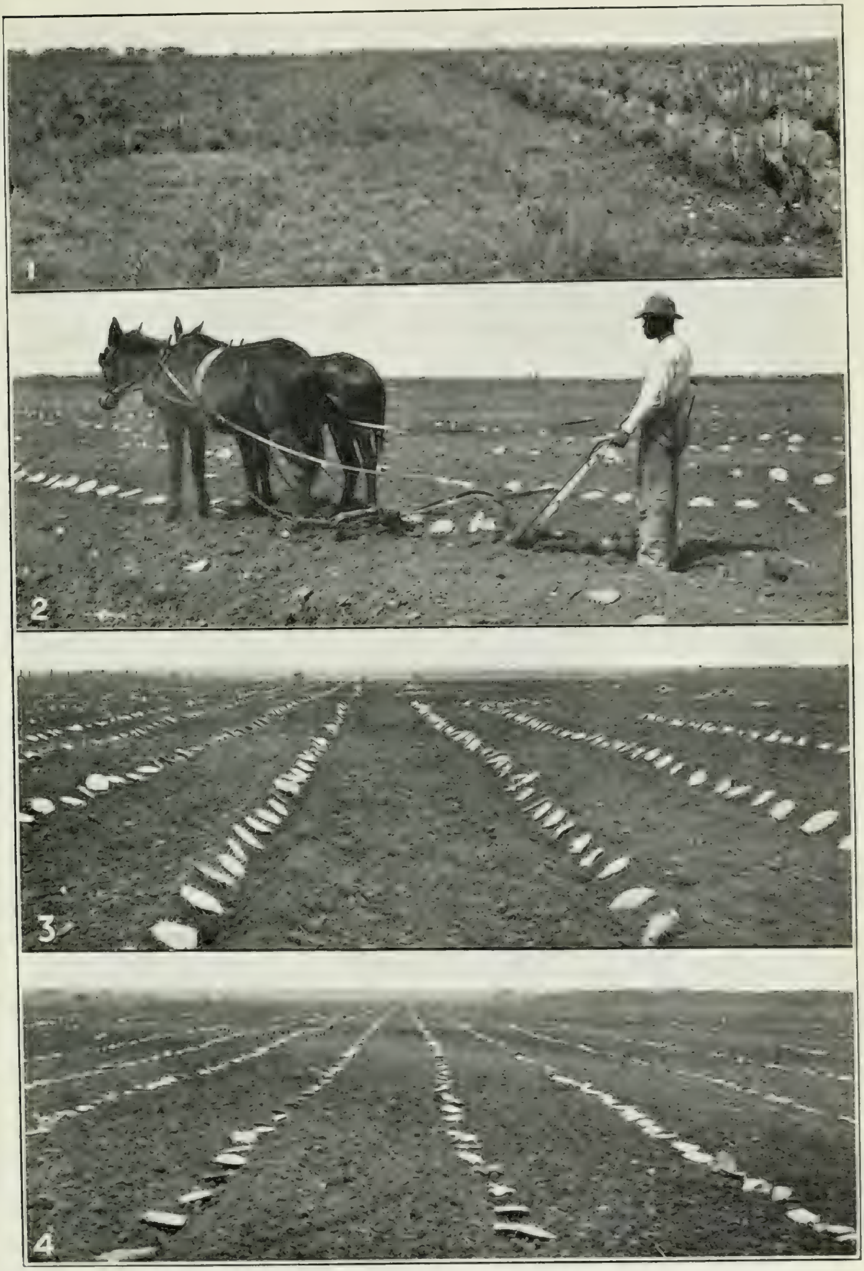
The diseased condition known as dropping of joints is believed to be purely climatical. This, while costing a month's growth in the spring, is not looked upon with any apprehension. The yields given in this paper have been secured in spite of this injury.

PLATES.

DESCRIPTION OF PLATES.

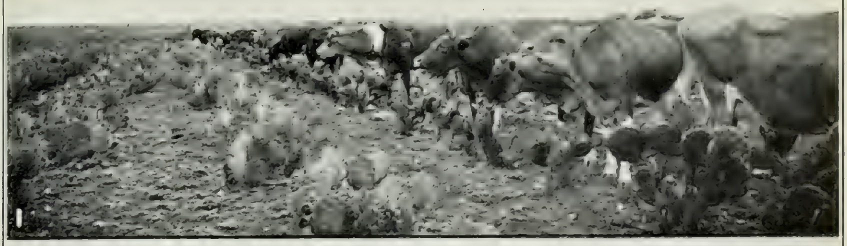
Plate I.—Prickly pear experiments. Fig. 1.—Cultivated and uncultivated prickly pear, showing relative growths. The first two rows cultivated and the first two rows uncultivated were planted in the same way and at the same time. The vegetation in the uncultivated area consists of native grasses and the broom weed (*Amphcacharis dracunculoides*). Fig. 2.—Covering the cuttings with a plow. Covered in this way they usually stand at an angle of about 45 degrees. Fig. 3.—Cuttings distributed in the furrow ready to be covered. When covered with a plow they stand at about the angle shown, but if a sulky cultivator is used to cover them they can be arranged nearly upright. In the distance will be seen piles of cuttings ready to be distributed. Fig. 4.—Cuttings distributed on the surface of the ground. These are not to be covered, but will grow readily in this position. This method of planting is to be recommended when the ground is thoroughly prepared and sufficiently moist.

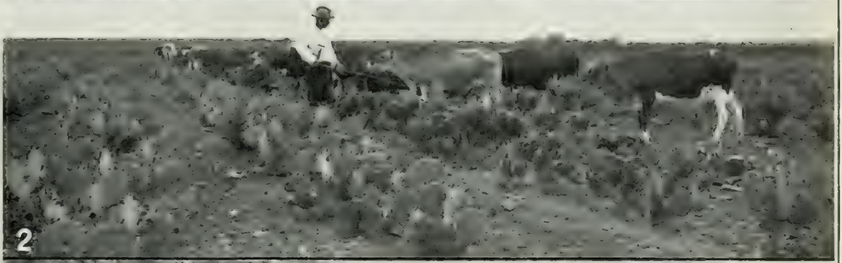
Plate II.—Prickly pear experiments. Fig. 1.—Cattle grazing singed prickly pear on the experimental plantation, March, 1907. Fig. 2.—Singeing 2-year-old pear upon the experimental plantation in March, 1907. Fig. 3.—Uncultivated plantation 20 years old upon the Poor ranch, at San Antonio, Tex. This plantation has been repeatedly harvested but never cultivated. Fig. 4.—Cultivated prickly pear 2 years old upon the experimental plantation. Compare the appearance of the plants with the same variety shown in figure 3.

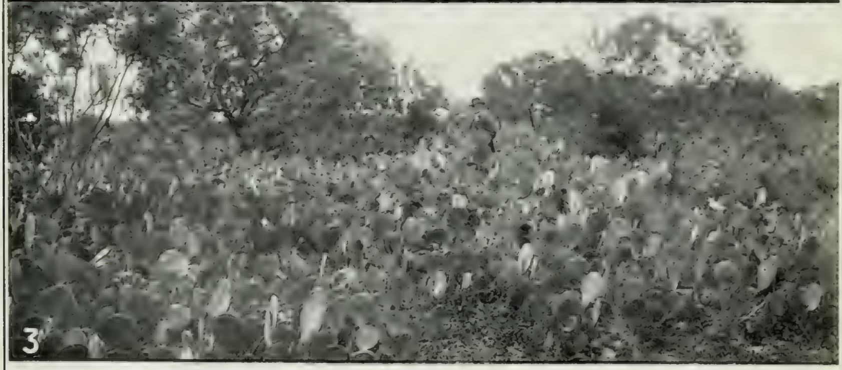


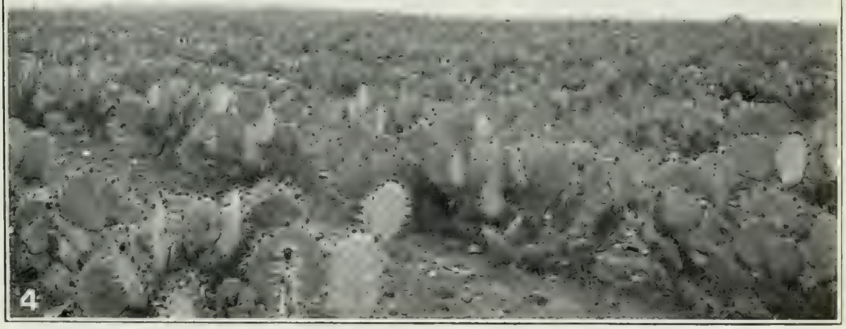
PRICKLY PEAR EXPERIMENTS.

Fig. 1.—Cultivated and Uncultivated Prickly Pear. Fig. 2.—Covering Cuttings with a Plow. Fig. 3.—Cuttings Distributed in Furrow Ready to be Covered. Fig. 4.—Cuttings Distributed on the Surface of the Ground, not to be Covered.









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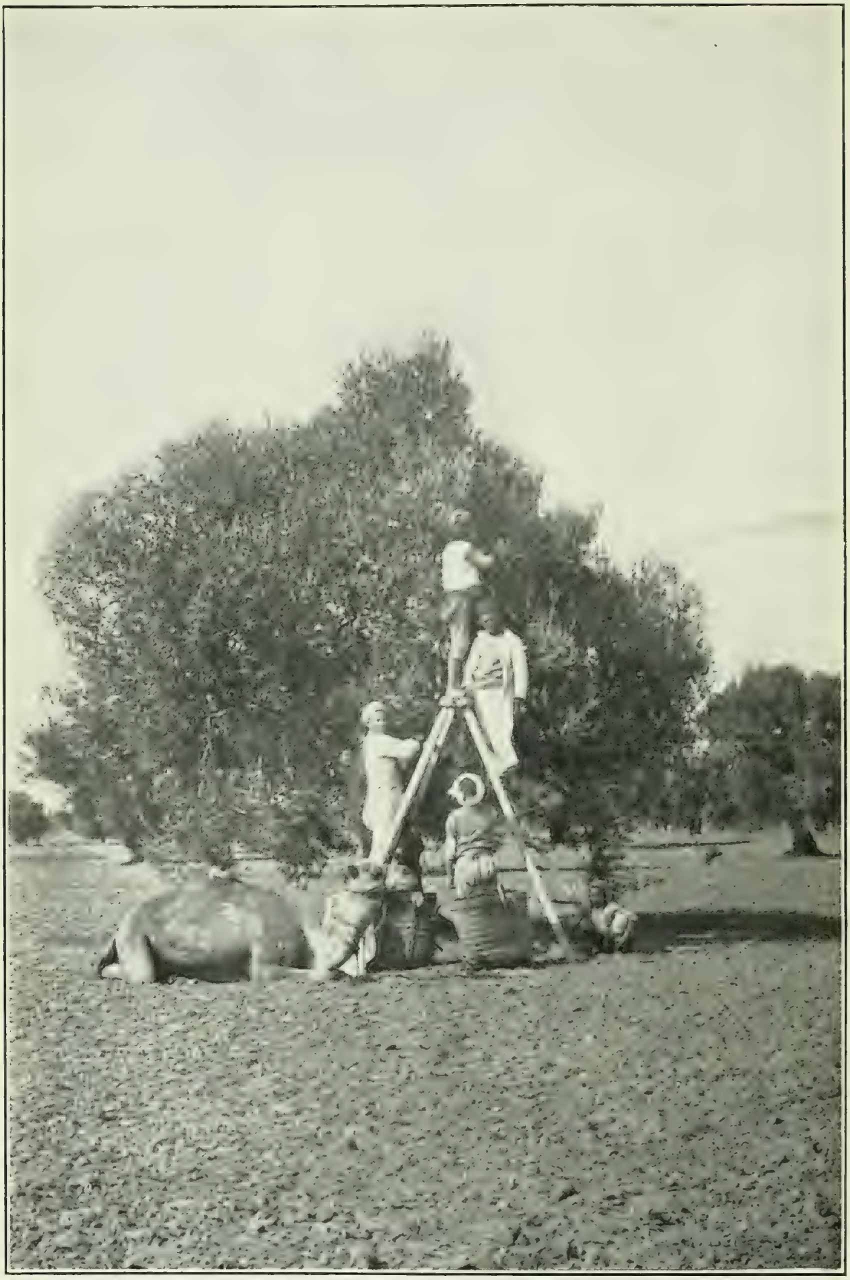

HARVESTING CHEMLALY OLIVES IN A DRY-LAND ORCHARD AT SFAX.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 125.

B. T. GALLOWAY, *Chief of Bureau.*

DRY-LAND OLIVE CULTURE IN NORTHERN AFRICA.

BY

THOMAS H. KEARNEY,

PHYSIOLOGIST IN CHARGE OF ALKALI AND DROUGHT RESISTANT PLANT-BREEDING INVESTIGATIONS.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., January 5, 1908.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 125 of the series of this Bureau the accompanying manuscript, entitled "Dry-Land Olive Culture in Northern Africa."

The culture of the olive without irrigation in a region where the average yearly rainfall is only 9.3 inches is the most highly successful example of dry-farming methods applied to a tree crop of which we have any knowledge. It has long passed the experimental stage, having been carried on in southern Tunis with the methods now in use for at least fifty years and having been developed on a vastly more extensive scale in the same region during the early centuries of the Christian era.

The description here given of the methods and of the type of tree adapted to this system of culture will be of special interest to that portion of the southwestern United States where olive culture is possible. But it also concerns arid and semiarid regions outside of the olive zone where arboriculture, based upon other crops, seems destined to become an important feature in dry-land agriculture. The present paper should stimulate the search for useful trees capable of being grown profitably under dry-farming conditions.

In the course of an expedition to Tunis for the Office of Seed and Plant Introduction and Distribution, the primary object of which was to obtain promising varieties of dates for trial in the southwestern United States, Mr. Kearney spent several weeks in the dry-land olive-growing districts studying the methods used and the conditions under which the culture is there carried on. This was done at the suggestion of Mr. W. T. Swingle, of this Bureau, who has charge of investigations in dry-land arboriculture.

The drought-resistant variety of the olive that is grown in Tunis has been introduced with a view to establishing dry-land olive culture in the United States. Investigations along this line will be carried on in cooperation between the offices of Plant Life History Investigations and of Alkali and Drought Resistant Plant Breeding Investigations.

Acknowledgment is here made of the valuable assistance rendered Mr. Kearney in the course of his investigations by the Tunisian authorities and by private individuals interested in olive culture. Mention should be made of the courtesies extended by M. Fidelle, late controleur civil at Sfax; M. Minangoin, inspector of agriculture in the Direction of Agriculture and Commerce at Tunis; Mr. Leonardi, British vice-consul at Sfax; M. Robert, president of the chamber of commerce at Susa; and MM. Louis Fidelle and A. Chatel, olive growers at Sfax.

The illustrations which accompany this paper are considered essential to a full understanding of the text.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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DRY-LAND OLIVE CULTURE IN NORTHERN AFRICA.

INTRODUCTION.

A great awakening to the possibilities of dry-land agriculture has recently taken place in the western United States. Land is being rapidly taken up and brought under the plow, largely by eastern farmers, in regions where the average yearly rainfall does not exceed 18 inches and where water is not available for irrigation. The unusually heavy rainfall of the past few seasons has allowed many of the newcomers to obtain good crops of small grain and forage under these conditions; but the recent recruit to "dry farming" must not lose sight of the fact that such periods of unusually heavy rainfall are sure to be followed sooner or later by periods of drought, when the plants ordinarily grown in humid regions will give him but uncertain results. To insure against disaster he should be on the lookout for drought-resisting varieties of the crop plants he is familiar with or else for new crop plants adapted to arid conditions.

No class of plants is more resistant to drought than certain trees and shrubs, some of which are extremely useful in countries having a climate similar to that of the Great Plains and Great Basin regions of the United States. Arboriculture (tree culture) is one of the safest and most promising lines along which dry-land agriculture can develop. Experience in various parts of the Old World has shown that drought-resisting trees will live and will often produce a crop in years when no shallow-rooted annual crop will return the seed sown.

The most highly developed and successful example of dry-land arboriculture known to the writer is based on the olive, a tree that is peculiarly well fitted for growing under arid conditions. Its leaves are protected against excessive loss of water by the thick skin or cuticle of the upper surface and by the scurf of scale-like hairs with which the under side is covered. Its root system is of such a nature as to permit it to grow without irrigation in regions where the rainfall is scanty and the ground water is practically out of reach. The roots of the olive run for long distances comparatively close to the surface of the soil, and are thus able to take up the moisture that penetrates a few inches into the ground after every moderate rainfall. The unusual hardiness of this tree is shown by the fact that in many localities in northern Africa where it was once planted it has persisted for centuries without receiving any attention, often running wild and mingling with the native trees and shrubs on the driest hillsides.

Fifteen hundred years ago southern Tunis was covered with thriving olive orchards, but these gradually disappeared after the country was conquered by the Arabs, so that at the beginning of the last century olive culture had almost died out in that region. A good beginning has since been made in reestablishing it, and to-day the dry-land orchards of southeastern Tunis are the wonder and admiration of olive growers the world over.

A description of this model arboriculture, of the climatic and soil conditions under which it is carried on, and of the methods used and the results obtained can hardly fail to interest those who are concerned in dry-land agriculture. It is true that in the United States the olive can be a profitable crop only in the warmer parts of the arid and semiarid districts, i. e., in southern and western Texas, in southern Arizona, and in California. But there are other drought-resistant trees that are better able to withstand cold and can therefore be grown to advantage farther north. Some of these, although not yet well known in the United States, are of great importance in various parts of the world, being grown either for their fruit, for forage, or for timber and fuel. In the drier parts of Europe and Asia there are varieties of our common orchard trees that would probably give better results under dry farming conditions than the varieties ordinarily grown in the humid parts of the United States or under irrigation in the West. An account of dry-land olive culture in Tunis should therefore be useful even outside the olive zone, as it will direct attention to the type of tree and the methods of culture that are likely to give the best results.

IMPORTANCE OF DRY-LAND ARBORICULTURE IN ANCIENT AFRICA.

Southern Tunis is to-day an arid, treeless waste, almost a desert, covered with a sparse growth of thorny bushes and coarse bunchgrasses. There are no streams of considerable size to furnish water for irrigation, and the average yearly rainfall is small, ranging from 8 to 14 inches. In many places a fair crop of wheat or barley can be expected only once in three or four years. This region is now uninhabited, save by a few thousand Bedouins, who wander from place to place in search of pasturage for their sheep and goats. Except on the coast and at a few points near the mountains along the northern and western borders of the district there are no large towns and hardly any permanent villages. The desolation is almost everywhere complete.

Yet during the third to the seventh century of the Christian era this whole district (fig. 1), from the seacoast westward into what is now eastern Algeria, was thickly dotted with thriving villages and farms. In an area not exceeding 20,000 square miles—15,000 within the boundaries of modern Tunis and perhaps 5,000 in Algeria—there were at least a dozen cities of 10,000 to 30,000 inhabitants. A network of splendid paved roads, such as the Romans knew so well how to build, connected these cities with each other and with those of the seacoast. While in the height of its prosperity, that part of the region belonging to what we now call

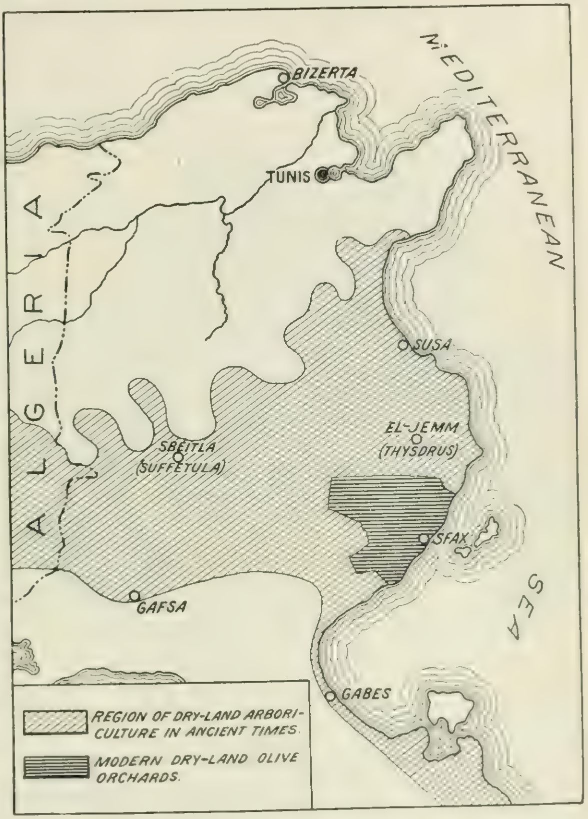

FIG. 1.—Map of Tunis,[a] showing the probable extent of the dry-land arboricultural region in ancient times and the area now occupied by dry-land olive orchards. (After Bourde.)

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[a] The northeastern portion of the lightly shaded area, at least near the seacoast, is not typical of the dry-land arboricultural region, the yearly rainfall at Susa averaging 16.6 inches. In the southeastern portion (below Gabes) it is unlikely that the dry-land orchards extended as far from the coast as is indicated on the map. In the absence of exact data for correction, however, it seems best to follow the limits of the region as traced by Bourde (Rapport sur les Cultures Fruitières, etc., Tunis, 1899).

Tunis, of which it formed about one-third, had a population of at least 1,500,000, or about the present population of the whole of Tunis.

The flourishing state of this part of Africa in former times is abundantly attested, not only by the statements of Arab writers who saw the country before it had completely relapsed into its present desolation, but by the ruins that are strewn over it in such numbers that one can hardly ride for half a mile without encountering some fragment of an ancient building, or cistern, or reservoir. The public buildings of the cities had a degree of architectural merit which shows that the ancient inhabitants enjoyed not merely prosperity, but wealth and luxury. The inscriptions prove that some of the finest of these structures were built not by the government or the municipality but by private citizens inspired by local pride, which was kept alive by the keen rivalry that existed among the towns of Roman Africa.

We need mention only two examples of the splendid development of this country in Roman times. In an area of 100 square miles around the ancient city of Suffetula (fig. 1) there have been found the remains of 3 cities, 15 towns, and 45 small villages, besides almost innumerable scattered farm buildings. Near the seacoast, on the site of the ancient city of Thysdrus (fig. 1), stands a great amphitheater which is second in size only to the Colosseum at Rome and is estimated to have seated 60,000 people. But the Roman city which it adorned has given place to a squalid Arab village huddled under the walls of the amphitheater, while around it in every direction stretches a bare, uncultivated plain. How can we account for the existence of the 60,000 souls that crowded the amphitheater of Thysdrus on festival days to view the sports of the arena? How did the teeming population of Suffetula support itself and accumulate wealth sufficient to build the beautiful marble temples and baths and theaters that adorned the city in the early centuries of the Christian era?

All the evidence goes to show that the climate has not changed materially and that the rainfall has not diminished since Roman times. We have no reason to believe that the country was formerly better watered or that agriculture based upon irrigation could ever have reached a high development in that part of Africa. The remains of innumerable cisterns lined with masonry or concrete—more than 400 have been counted in one small district near Sfax alone—prove that the inhabitants had to depend for domestic purposes upon stored rain water. Some of the larger cities had public cisterns of gigantic size. Even near the mountains it was necessary to utilize every spring and to build long aqueducts to carry water to the cities and towns. There could have been little to spare for agricultural purposes, except, perhaps, to irrigate the gardens immediately around the towns.

The gnarled old olive trees that are found here and there over the country (fig. 2), often standing in straight rows just as they were planted centuries ago,[a] and the almost innumerable ruins of oil mills answer our questions. The remains of more than a thousand oil mills are said to exist in the hundred square miles around Suffetula alone. They were built of stone and were often of imposing size. In many places the stone basins in which the fruit was crushed and the perforated stone pillars that supported the bar of the press are still to be seen.

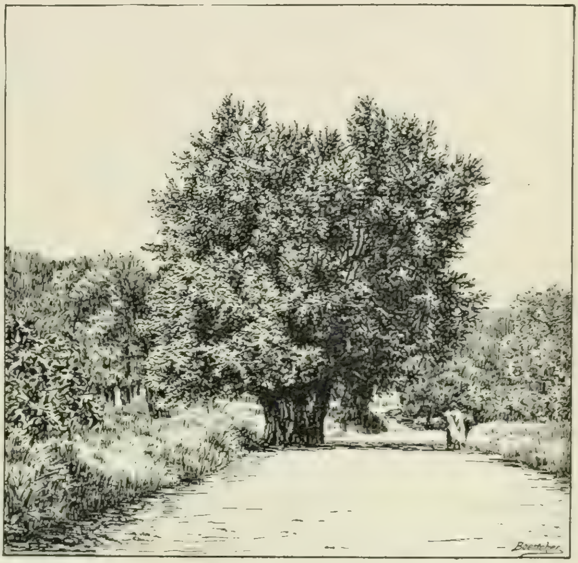

FIG. 2.—An olive tree, probably several centuries old, growing without irrigation in Algeria.

If we turn to the Roman and Arabic historians and geographers, we find abundant evidence that the wealth of this part of Africa was based upon dry-land tree culture on a vast scale.[b] The olive was undoubtedly the chief source of these riches, although other more or less drought-resistant trees, such as the pistache, fig, and almond, doubtless played an important part. It has been calculated that the olive orchards of southern Tunis covered 2,500,000 acres when the Arabs conquered the country, about 700 A. D. Ancient Rome, which consumed an enormous quantity of olive oil, drew its supply largely from this region. Under the Cæsars the province of Africa, which comprised the same territory as modern Tunis, was taxed 300,000 gallons yearly for the benefit of the capital.[c] So important was this article in the ancient commerce of the country that, as the local tradition has it, one of the cities near the eastern coast built a conduit solely for the purpose of transporting oil to its seaport.

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[a] Olive trees several hundred years old are frequently met with in Algeria and Tunis. In many places the existing trees are offshoots that have sprung up from the roots of older ones, the original trunk having long since disappeared.

[b] This view was first advanced in a convincing form, with an admirable summing up of the historical and archæological evidence, by P. Bourde, at one time Director of Agriculture in Tunis, in a little pamphlet entitled "Rapport sur les Cultures Fruitières et en Particulier sur la Culture de l'Olivier dans le Centre de la Tunisie." (Report on Fruit Culture and Especially Olive Culture in Central Tunis.) Tunis, 1892; 2d edition, 1899.

[c] Graham, Alexander. Roman Africa, London, 1902, p. 57.

The Arab invaders, being a pastoral and not an agricultural people, are said to have wantonly destroyed the olive orchards in order to create pastures for their flocks. More probably the orchards gradually died out from neglect, large numbers of the original inhabitants of the country having been killed or driven from their farms by the invaders, who neither knew nor cared anything about tree culture. During the centuries that followed, the country was in too turbulent a state to make a restoration of the olive orchards possible. Moreover, the decline of Rome and the destruction of commerce on the Mediterranean put an end to the foreign trade in oil and left Tunis without a market for its surplus production.

However this may be, only mere fragments of this magnificent forest of olives remain to-day in southern Tunis. In the northern part of the country, where the rainfall is much greater and the trees can exist without the use of special cultural methods to conserve moisture in the soil, olive growing has continued without interruption down to the present time.

DRY-LAND OLIVE CULTURE IN MODERN TUNIS.

At a few points along the coast in central and southern Tunis the orchards never disappeared entirely, and within the last century a notable effort has been made to reestablish the ancient condition of things in the neighborhood of Sfax, a thriving seaport on the eastern coast (fig. 1). The work was begun by the inhabitants on their own initiative, hesitatingly and inefficiently at first. About 1840 the system of planting and of tillage now in use was introduced or revived[a] by one of the more intelligent natives, and from that time the progress was rapid. When the French occupied Sfax in 1881 the orchards already covered 45,000 acres, and up to that time Europeans had had no part in the work.

During the last twenty years most of the new orchards have been created by French capitalists, although native laborers have been almost exclusively employed and the cultural methods are essentially those in use before the country was occupied by Europeans. Between 1892 and 1904 French stock companies and individual colonists purchased from the Tunisian government 200,000 acres of public land and planted more than one and a half million olive trees, besides a large number of almonds. These lands are sold by the government at the rate of 75 cents an acre, one-half of the price being payable in advance and the remainder within four years, on condition that the purchaser shall put the land into a tree crop before the end of that time. This is in pursuance of the policy of the government to encourage in every possible way the restoration of the olive orchards that made the country prosperous in ancient times.

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[a] In all probability the system of wide spacing of the trees and thorough tillage is not a recent invention, but was in use by the Romans more than 1,500 years ago. These practices, or at least the tradition of them, doubtless continued to exist in the region through all the centuries of the Arab domination, to be brought once more into general use during the past century.

At present the orchards extend without interruption to an average distance of 20 to 25 miles from Sfax, while some of the outlying plantations are as much as 40 miles distant from the town. Those within a radius of 12 miles from Sfax, which are now in full bearing, belong almost exclusively to natives, while beyond them are the plantations of young trees more recently established by French colonists. These newer orchards are in nearly all cases very large, some of them containing more than 25,000 trees. The entire area around Sfax occupied by dry-land olive orchards was estimated in 1900 to be 475,000 acres, containing 3,333,000 trees. During the ten years from 1896 to 1905 a yearly average of more than 1,000,000 gallons of oil was produced. The product of these orchards is sufficient to maintain about two dozen oil mills in the town of Sfax, operated by Europeans and equipped with modern machinery, besides twice as many native mills, in which the power is furnished by animals.

This wide expanse of orchards is a most impressive sight. The best view of it (see Pl. IV, fig. 1) is to be had from the summit of a little hill about 10 miles northwest of Sfax to which all visitors are taken. The straight rows of trees, separated by broad bands of bare, reddish soil, stretch to the horizon in almost every direction. The whole face of the country is striped with gray-green and red. Probably nowhere else in the world has olive culture been so highly developed. The regularity of the planting is striking to anyone who is familiar with the haphazard way in which the trees are set out on hillsides in most parts of the Mediterranean region.[a] The trees stand in perfectly straight lines and are 65 to 80 feet apart in each direction. They are carefully trimmed so as to have a symmetrical, square-topped spread of foliage and are remarkably uniform in size and shape. Nothing else is grown among them after they begin to bear, and the cultivation is so clean that it is hard to find a blade of grass in the well-cared-for orchards.

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[a] The jury for olive culture of the Congress held at Tunis in 1888, which was composed largely of French olive growers, agreed that the plantations at Sfax are "superb and leave far behind anything to be seen in Europe as to development of the trees and quantity of the fruit." At that time the orchards were still practically all in the hands of natives.

This admirable culture is carried on without irrigation in a region where the rainfall averages only 9.3 inches and sometimes falls as low as 6 inches during several successive years. It is the most successful example of dry farming applied to a tree crop of which we have any knowledge.

In order to understand the cultural methods practiced, it is necessary first of all to know something of the physical conditions of the Sfax region.

GENERAL CHARACTERISTICS OF THE SFAX REGION.

CLIMATE.

Sfax, like most localities in northern Africa, has many of the climatic peculiarities of the vast Sahara Desert, which practically reaches the sea near the border of Tripoli, 110 miles southeast of Sfax. For this reason the climate of the east coast of Tunis, even as far north as the city of Tunis (fig. 1) is much more desert-like than the coast of Algeria, which is separated from the Sahara by two ranges of mountains. At Sfax the chief points in which the climate approaches that of the desert are the small rainfall and the long, hot summers. Yet it is not a typical desert climate, for the neighborhood of the sea gives it a comparatively high relative humidity and smaller daily and seasonal ranges of temperature than those that characterize the Sahara itself.

Table I shows the average monthly temperatures at Sfax:

TABLE I.—*Monthly and annual average mean, mean maximum, and mean minimum temperatures at Sfax, in degrees Fahrenheit.*[a]

Month.	Mean.	Mean of the maxima.	Mean of the minima.
	F.	°*F.*	°*F.*
January	51.3	59.1	43.3
February	54.4	61.8	46.9
March	59.1	67.2	50.2
April	63.2	72.1	54.9
May	68.8	77.5	60.5
June	72.8	80.9	65.9
July	78.5	87.8	72.0
August	79.3	88.1	72.9
September	78.4	86.6	73.2
October	72.8	79.4	64.5
November	61.8	69.1	53.7
December	54.0	62.5	45.8
Annual mean	66.2	74.3	58.6

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[a] The monthly means for Sfax are based upon records covering a period that varies in length for different months from eight to seventeen years, but they have been corrected so as to agree with the sixteen-year means for each season (winter, spring, summer, and autumn) given by G. Ginestous (Etude sur le Climat de la Tunisie, Bul. Dir. Agric. et Com. Tunis, 1902 and 1903). The correction in most cases amounts to only about 1° F. and in no case exceeds 3°.

Most localities in the southwestern portion of the United States are characterized by a greater range of temperature than occurs at Sfax, having colder winters and warmer summers. At Tucson, Ariz., the monthly mean temperatures are much like those at Sfax, except for May, June, July, and August, when the temperatures are considerably higher at Tucson. The means of the maxima of the spring and summer months are much higher at Tucson than at Sfax, while the means of the minima are much lower at Tucson during the nine months from September to May. The yearly mean of the maxima is nearly 8 degrees higher, and the yearly mean of the minima is 6½ degrees lower at Tucson than at Sfax.

San Antonio, Tex., corresponds closely with Sfax in the mean temperatures of all the months, except April, May, and June, when the monthly means are considerably higher at San Antonio. The monthly means of the maxima are uniformly somewhat higher at San Antonio, the difference being most marked for the months of April to July. The monthly means of the minima at San Antonio are slightly lower in autumn and winter but somewhat higher in spring and summer than at Sfax.

There is no evidence, however, that within wide limits temperature is a factor of very great importance in olive culture.

Table II shows the average monthly and annual precipitation at Sfax:

TABLE II.—*Average monthly and annual precipitation at Sfax.*[a]

Month.	Precipitation.	Month.	Precipitation.
	Inches.		*Inches.*
January	0.97	August	0.04
February	1.17	September	0.78
March	0.70	October	1.17
April	1.25	November	1.21
May	0.58	December	1.36
June	0.08		
July	0.04	Total annual	9.35

[a] Based upon a period of fifteen years (1886 to 1900). The above data are taken from G. Ginestous, Les Pluies en Tunisie, Dir. Gén. de l'Enseignm. Publ., Serv. Météorol., ed. 2, pp.. 86, 87 (1901).

If we compare the rainfall of Sfax with that of localities in the southwestern United States, we find that San Diego and Fresno, Cal., Tucson, Ariz., and El Paso, Tex., have practically the same yearly total, while at San Antonio, Tex., the yearly total is about three times as great, and at St. George, Utah, only about two-thirds as great. In the distribution of the rainfall during the different months of the year, San Diego and Fresno most nearly resemble Sfax, while Tucson, El Paso, and San Antonio show a marked difference in their relatively heavy midsummer rainfall. Most of the precipitation at Sfax occurs in the autumn, winter, and early spring.

December being the month of greatest rainfall, with a second maximum, only slightly lower, in April. July and August are the driest months.

The total rainfall at Sfax varies greatly in different years. Thus, in 1890 it amounted to 17.4 inches, and in 1895 it was only 3.2 inches. During the seven years from 1898 to 1904 the total rainfall was only 41 inches; hence the yearly average was only 5.8 inches. The relation that apparently exists between the rainfall and the size of the olive crop is discussed farther on.

There are no perennial streams in the Sfax region. The inhabitants depend upon wells and cisterns for water for irrigating their gardens and newly set out olive trees as well as for household purposes. The wells vary greatly in depth. For instance, about 30 miles north of the town there is a well 220 feet deep, while only 3½ miles away there is a 33-foot well. The average depth is perhaps between 50 and 80 feet.

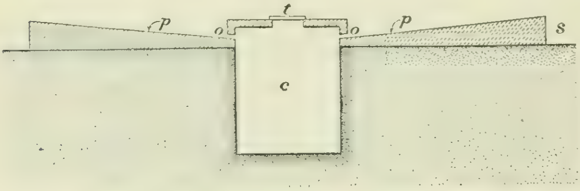

FIG. 3.—Diagram showing construction of cisterns at Sfax, being a section through two of the openings (*o*) in the concrete cover (*t*) by means of which water that falls upon the platform (*p*) enters the cistern (*c*); *s* is the surface of the soil.

In the zone of gardens containing a variety of fruit trees which lies between the town and the olive orchards, the roads are bordered by cisterns of a peculiar type (fig. 3). A concrete platform, often 40 or 50 feet square and about 2 feet high at the edge, slopes from all sides toward the center, the opening of which is protected by a concrete cover. Small holes in the sides of the cover allow the water that falls upon the platform to enter the cistern beneath. Water is drawn when needed through a hole in the top of the cover, which is protected by a movable lid. This type of cistern has been used in Tunis for two thousand years or more.

In years of unusually small rainfall, such as 1904, water becomes so scarce that 4 or 5 gallons (the capacity of the ordinary water jar used by the natives) are retailed for 2 cents. It has been necessary at times to import drinking water from Naples and to use sea water for washing clothes.

TOPOGRAPHY AND SOILS.

TOPOGRAPHY AND NATURAL VEGETATION.

The portion of southern Tunis in which dry-land olive culture reached its highest development in ancient times is that where Quaternary deposits form the surface covering. The district around Sfax that is now occupied by olive orchards is a slightly rolling plain of low elevation, extending from the coast toward the base of the high table-land that occupies central Tunis. In its natural condition it is a steppe, in many ways like the great plains east of the Rocky Mountains, and especially like parts of western Texas and eastern New Mexico. It bears a scattered vegetation, a conspicuous feature of which is the Christ thorn (*Zizyphus spina-christi*), a spreading thorny bush with most of the trunk underground, thus resembling the mesquite (*Prosopis juliflora*) as it grows in eastern New Mexico. Like the mesquite, the Christ thorn generally occupies the summits of small mounds, which it has probably helped to form by catching and holding wind-blown soil. While its stems are usually only 4 or 5 feet high above ground, its roots are said often to penetrate to a depth of 12 feet or more. The presence of this shrub makes the clearing of the land difficult and expensive. Sagebrush (a species of Artemisia) and coarse bunch-grass make up the bulk of the natural vegetation.

SOILS.

The soil that is considered most desirable for olive culture is bright red in color. It is generally of considerable depth, but at some places within 20 miles of Sfax hardpan is said to be encountered only 24 inches below the surface. To an average depth of 7 feet the soil appears to be generally rather uniform in texture, but below this strata of fine material alternate with layers of coarse sand and gravel. As regards water content, it is stated[a] that when the surface soil was air dry, at a depth of 8 inches the moisture content was found to be 6 per cent, at 20 inches 10 per cent, and at 40 inches 14 per cent. This would indicate a distribution of soil moisture to which only trees and deep-rooted perennials could adapt themselves. It is said[b] that even after several months without rain the soil at a depth of 8 inches contains enough moisture to stick together when squeezed in the hand. At the end of January, 1905, however, when heavy rains had followed a prolonged drought, the writer observed that while the first 8 inches of the soil had been thoroughly moistened the next 16 to 24 inches were very dry and powdery.

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[a] Bourde, P. Rapport sur les Cultures Fruitières * * * dans le Centre de la Tunisie, 2d edition, 1899, pp. 13, 14.

[b] Bertainchand. Note Explicative sur la Carte Agronomique et Hydrologique * * * des Terres de la Région de Sfax, Paris, 1896, p. 16.

As to texture, this soil when dry has the appearance of a sandy loam, with rather coarse particles. An average of the results of mechanical analyses by the chemist of the Tunisian government[a] of 82 samples collected in every part of the Sfax region gives 80 per cent of "coarse sand" and 20 per cent of "fine material." Yet an apparently typical sample collected by the writer in an olive orchard about 5 miles from Sfax was found by the Bureau of Soils of the United States Department of Agriculture to contain a great deal of silt and clay, amounting together in the surface foot to 45 per cent of the whole and in the third foot to 23 per cent. The remaining 55 and 77 per cent, respectively, consisted mainly of "fine sand" and "very fine sand." The real state of the case appears to be that in the natural condition of the soil these fine particles are held together by lime or some other cementing material, so as to form particles that resemble grains of coarse sand. These become separated when the soil is shaken for a long time in water.[b]

Table III shows the results of mechanical analyses made by the Bureau of Soils of the United States Department of Agriculture of soil samples from the Sfax olive orchards.

TABLE III.—*Mechanical analyses of soil samples from the olive orchards of Sfax.*

Locality.	Depth taken.	Fine gravel, 2 to 1 mm.	Coarse sand, 1 to 0.5 mm.	Medium sand, 0.5 to 0.25 mm.	Fine sand, 0.25 to 0.1 mm.	Very fine sand, 0.1 to 0.05 mm.	Silt, 0.05 to 0.005 mm.	Clay, 0.005 to 0 mm.
	Inches.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
Olive orchard, Sfax	0 to 12	0.2	4.3	7.1	24.1	20.9	14.1	30.0
Do	13 to 24	.4	7.7	9.7	33.9	24.0	9.1	16.0
Do	25 to 36	.5	7.9	10.3	34.3	24.6	7.1	15.7
Do	0 to 12	.2	4.6	6.8	26.4	22.5	13.4	26.2
Olive orchard, 20 miles north of Sfax	(*)	.3	2.7	3.3	14.9	27.0	22.9	29.3

* Adhering to olive truncheons, probably about 12 inches.

Chemical analyses of a large number of samples of the Sfax olive soils by the chemist of the Tunisian government show them to be very rich in lime (calcium carbonate), of which there is an average of from 5 to 10 per cent. The potash content is also good, the average being 0.1 to 0.2 per cent. On the other hand, they are rather poor in nitrogen (0.03 to 0.05 per cent) and in phosphoric acid (0.04 to 0.05

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[a] Bertainchand, l. c.

[b] In the French method of mechanical analysis of soils, much less water is used and the digestion is much more rapid than in the method followed by the Bureau of Soils; consequently by the former method the aggregates of fine particles are less likely to be broken up through the solution of the cementing material.

per cent). According to Trabut,[a] a high lime content is a very favorable factor in growing olives for oil production, as olives produced in limestone regions are richer in oil and the oil is of better quality than where the soils are deficient in this component. It should be noted that while the nitrogen and phosphoric acid content of the Sfax soils would be considered low for most crops, the high yields and good quality of the oil produced at Sfax are sufficient evidence that the supply of these two elements of plant food must be amply sufficient for the requirements of the olive. This can perhaps be explained by the fact that the roots of this tree occupy so great an area of soil (one-seventh to one-tenth acre) that while the percentage of these elements to weight of soil is everywhere low the total amount available to the roots is actually rather high.

THE OLIVE ORCHARDS OF SFAX.

THE VARIETY GROWN.

The Sfax orchards contain only one oil-producing variety, the Chemlaly,[b] to which probably at least 95 per cent of the trees belong, the rest being varieties with larger fruits used for pickling. The fruits of the Chemlaly are very small but are produced in great quantity (Plate III). They are exceedingly rich in oil, yielding 30 per cent in factories where modern presses are used and as high as 34½ per cent in extraction experiments made by the chemist of the Tunis government. These are unusually high percentages, but they are attributable, perhaps, more to the heat of the climate than to a peculiarity of the Chemlaly variety, for still farther south in Tunis the olives are even richer in oil. In the extraction experiments above referred to, olives grown in the celebrated oil-producing district of Bari in southern Italy yielded only 28.2 per cent. In European countries near the northern limit of olive production the fruit is said to yield only 13 per cent of oil.

Oil made from the Chemlaly variety is very pure and of excellent flavor. For commercial purposes, however, it has a serious defect in its high content of stearin, or fixed acid, which causes it to congeal at relatively high temperatures. This characteristic renders Sfax oils difficult to sell in northern Europe, and it is especially prejudicial to their use in preserving sardines, etc. It is not, however, an insuperable objection, since the excess of stearin can be removed at a relatively small expense.

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[a] Trabut, L. L'Olivier, Bul. 21, Service Bot., Gouvernm. Gén. Algérie, 1900, p. 43.

[b] Five or six very different varieties, all known as Chemlaly, occur in Tunis. That grown at Sfax is commonly designated as the "Chemlali de Sfax."

Opinions differ as to whether the high stearin content of the Sfax olive oils is a peculiarity of the Chemlaly variety or is due to the character of the soils of Sfax. That it is not attributable to the climate seems certain, for oils made from olives grown in still hotter and drier parts of Tunis are said not to congeal more readily than do those from the northern part of the country. M. Bertainchand, the chief chemist of the Tunis government, holds the character of the soil to be responsible, the soils in which olives are grown in northern Tunis being generally heavier than those of Sfax. It should be noted, however, that oils produced in the oases on the northern edge of the Sahara, where the soils are sandier than at Sfax, resemble the oils of northern Tunis rather than those of Sfax in their percentages of fluid and fixed acids. Perhaps the low water content of the soil contributes to this peculiarity in the composition of Sfax oils, northern Tunis having a much higher rainfall and the oases being abundantly irrigated. The latest authority who has investigated this subject holds, however, that the percentage of stearin is essentially a characteristic of the variety rather than a direct result of the physical conditions.[a]

Whether the large yields of fruit obtained at Sfax from the Chemlaly olive are an inherent characteristic of the variety or are due to the climate or the soil or the superior cultural methods used seems not to be known. All authorities agree, however, that this variety is exceptionally well adapted to growing without irrigation in a hot, dry climate. It has been suggested by Dr. L. Trabut, government botanist of Algeria, that the Chemlaly will probably be useful as a drought-resistant stock upon which to graft larger fruited varieties. It is, in fact, thus employed to some extent at Sfax, but its value for this purpose will probably be limited, since olives that are large enough to be commercially valuable for pickling can in all likelihood be produced only where abundant water is available.

PROPAGATION.

The Chemlaly olive is never grafted at Sfax but is grown on its own roots. It is always propagated by means of large truncheons—pieces of wood taken from the base of the trunk or of the largest roots—a method that seems to be peculiar to Tunis.[b] These cuttings are obtained from the old neglected trees—relics of the ancient olive orchards—that are scattered over the country (see fig. 2). When such trees do not occur on the estate that is to be planted, the cuttings are purchased from natives who have them. Either the whole tree is uprooted and all the cuttings it can furnish are removed at once with a saw or else only two or three are taken off at a time. In the latter case the usual method is to cut with a hatchet about half way through the root that is selected to furnish the cutting, at two points 8 to 10 inches apart. A spade is then struck into the upper cleft and the root is split down the middle as far as the lower cleft, thus leaving unhurt the under half of the root from which the cutting has been removed. The wounds are carefully trimmed with a pruning knife. In this way the root which furnishes the cutting is left attached to the parent tree and continues its functions.

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[a] See Marcille, in Bul. Dir. Agric. et Com., Tunis, 1906, p. 516.

[b] Dr. L. Trabut, the government botanist of Algeria, states that it is not practiced in Algeria. Prof. S. C. Mason, arboriculturist of the Bureau of Plant Industry, reports that the cottonwood (*Populus deltoides*) is sometimes propagated in western Kansas by means of "snags," or truncheons, pieces of wood with several buds obtained by cutting up the branches of this tree. They are of the thickness of a piece of stove wood and 1 or 2 feet long. They are sometimes set in deep furrows and the soil is then firmed in around them.

The truncheons thus obtained are generally 8 to 10 inches long and of very unequal thickness, although said to average 4 inches. The drier the weather and the soil at the time of planting the larger they should be. In no case should they weigh less than 2½ pounds, and they are generally heavier, for the vigor of the tree for the first year or two, at least, depends largely upon the size of the truncheon from which it originates. They retain the bark and should have at least three eyes or buds. If they have roots attached, these are cut off and care is also taken to trim away all rotten wood. The best results are obtained with cuttings taken below the surface of the ground. When of the dimensions just described they will not be injured by exposure for two weeks to the sun and air, but if a longer interval elapses before they are planted they should be wrapped in straw or else buried in the ground until wanted.[a]

CLEARING THE LAND.

The first step in establishing an olive orchard at Sfax is, of course, clearing the land of its native growth of grass and bushes. Where the deep-rooted thorny shrub known as Christ thorn occurs this is a troublesome and expensive operation, but otherwise a fairly deep plowing is generally effective. As a rule, the greatest difficulty in getting the land clean and keeping it so is due to the presence of Bermuda grass, the worst weed of the Sfax region. As irrigation is not practiced, except that the young trees are watered by hand during the first one or two summers after planting, it is not necessary to level the land. In the largest plantations it is the custom not to clear the entire surface before planting but merely strips about 12 feet wide, in the centers of which the rows of trees are to be set. These strips are broadened from year to year until the whole surface of the orchard has been freed from weeds and brush. Whenever possible, however, it is preferable to clear the entire area at the outset, since the unreclaimed portion harbors Bermuda grass, which rapidly spreads into the strips containing the rows of trees.

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[a] Four dozen such cuttings were imported from Sfax by the Department of Agriculture in 1905. They were taken from the trees about February 15 and were covered with soil until the end of the month, when they were packed with wet straw in ventilated wooden boxes and shipped to New Lork, being watered at least once during the voyage. When unpacked at Washington on April 20, only one or two of them showed signs of life. When planted, however, hardly one failed to send up numerous shoots, which by October 15 had reached a height of 4 to 5 feet. They were sent to San Antonio, Tex., Tucson and Phoenix, Ariz., and several localities in California. In most cases they have made a good growth, and material for further experiments with this variety seems to be assured.

PLANTING.

DISTANCE BETWEEN THE TREES.

Wide planting, combined with clean cultivation (see Pls. II and IV), is the chief factor of success in olive culture at Sfax. Fifty years ago the Arabs hit upon the plan of setting out the trees about 80 feet apart each way, thus giving slightly less than seven trees to the acre; but this small number is said to produce as much oil as do 50 trees at Susa or 60 to 80 trees in northern Tunis. The natives continue to plant at this distance, but there is a tendency among the French owners of orchards to decrease the distance between the trees to 65.5 feet, which gives space for 10 trees to the acre if planted in squares and 11½ trees if planted in quincunx, as is now frequently done by French olive growers. This system of wide planting conforms to the habit of the olive tree, at least when grown under the climatic and soil conditions of Sfax. It is there a comparatively shallow-rooting tree,[a] but the roots form a dense network extending horizontally to an average distance, it is said, of 25 feet in every direction. The root systems of two olive trees at Sfax 80 feet apart have been observed to meet.

Great care is taken, even by the natives, to secure a perfect alignment of the trees and to plant them at exactly equal distances. Consequently the Sfax orchards are models of systematic planting.

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[a] One olive grower at Sfax informed the writer that practically the entire root system is contained in the first 3 feet of the soil. The shallow-rooting habit of the olive at Sfax may be at least partly due to the method of propagation by truncheons, which prevents the formation of a taproot. Rooted cuttings, such as are used in other parts of Tunis, are said to quickly develop a taproot. There is little doubt, however, that the olive is more shallow rooting than most fruit trees.

TIME AND METHOD OF PLANTING.

The trees are set out from November to February, but the best months are November and December, the benefit of the winter rains being thus secured. When heavy rains occur immediately after planting, as many as 98 per cent of the trees sometimes live, but ordinarily only 80 per cent survive. If the truncheons are set out in November, the shoots appear the following spring. If planting is deferred until February, the shoots do not ordinarily appear until the following autumn, or even the second spring, and the percentage of trees that fail to grow is often very large.

The truncheons are always planted at the bottom of holes (see fig. 4), these being generally 2 feet square and 2—or sometimes 2½—feet deep. The young shoots are thus partially shaded, and the soil around them can be kept much more moist than if the truncheons were planted near the surface of the ground. It is advisable to prepare the holes several months before planting, in order that the soil at the bottom may become thoroughly aërated and be moistened by the first autumn rains. For November planting it is recommended that the holes be made in June or July, since at that time the soil is still moist from the spring rains and hence easy to work. In a light soil a native laborer can dig these holes at the rate of fifty a day.

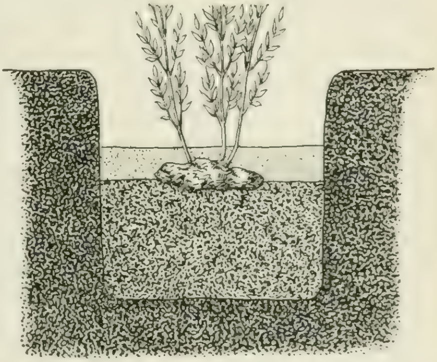

FIG. 4.—Diagram showing method of planting olive truncheons at Sfax. (After Minangoin.)

In planting, the hole is about half filled with loose soil. The truncheon is laid on this, the side on which the bark remains and which contains the buds being of course uppermost. It is then pressed down and covered with about 2 inches of soil. Manure is never put into the hole. As the shoots push up, the hole is filled until, two or three years after planting, it is nearly level with the surface; but it is desirable to maintain a slight depression, in order to hold as much water as possible around the young tree.

Of the numerous shoots that spring up from the truncheons, all are preserved the first year, but during the second year all but the two most vigorous ones are removed, and during the third year only the best and strongest shoot is allowed to grow.

Occasionally the truncheons are planted in nursery form before being set out in the orchard. In a large orchard thus established near Sfax that was visited by the writer, the trees, after having grown one year in the nursery and three years in the orchard, were 5 to 6 feet high above ground. Ordinarily, olive trees grown from these large pieces of old wood begin to bear when six years of age, but do not give any considerable amount of fruit until ten years old.

The estimated cost of planting one hundred trees in the manner above described is $4.75 to $5.30, including the purchase and transportation of the cuttings, digging the holes, and planting. This is only possible because of the very cheap labor obtainable in Tunis, 40 to 50 cents being the ordinary day's wages of laborers in the olive orchards at Sfax.

WATERING THE YOUNG TREES.

While the olive orchards at Sfax are not irrigated after they are once established, sufficient water for that purpose being unobtainable, it is usually necessary to water the young trees during the first summer or two after they are set out. For this purpose the water of wells and cisterns is used. There seems to be much diversity of opinion as to the number of waterings that are necessary, but the usual practice appears to be to water two or three times during each of the first two summers after planting, at the rate of 5 to 10 gallons to the tree at each watering. Frequently the young orchards are given no water during the second summer. In one plantation visited by the writer the trees were watered only once after planting. It is said that in exceptionally rainy years no watering whatever is necessary and that the trees planted in such years make the best growth. The labor required in watering is a considerable item in the expense of establishing an olive orchard at Sfax, the nearest well being often a mile distant from some of the trees.[a] The natives water their trees by means of earthenware jars holding 4 or 5 gallons, but on the large plantations owned by Europeans a watering cart is generally used. To facilitate its passage, a strip of land 6 feet or so wide on either side of the rows of trees is left unplowed during the summer.[b]

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[a] Minangoin estimates that there should be one well to every 570 acres of orchard. (L'Olivier en Tunisie, 1901, p. 57.)

[b] As a means of avoiding at least part of this laborious watering, it was suggested to the writer by M. Louis Drappier, of the Service des Antiquités et des Beaux Arts at Tunis, that a practice followed by the Arabs in establishing orchards in parts of Algeria where water is scarce might be advantageously adapted to dry-land olive culture. This consists in placing in the bottom of each hole in which a young tree is to be set about 100 pounds of cactus pads and covering them with a thin layer of soil, upon which the young tree is set. It is said that a supply of moisture sufficient to last two years is thereby assured. It would seem doubtful, however, whether an adequate supply of moisture would thus be provided and also whether good conditions for the roots of the young trees would result from this manner of planting.

TILLAGE.

Good tillage is essential to successful dry-land olive culture as practiced at Sfax, and this was thoroughly appreciated from the beginning by the intelligent natives who brought the present system into general use once more. In order to keep as much moisture as possible in the soil, a dust mulch, which reduces evaporation to a minimum, is maintained on the surface, especially during the summer. This loose condition also facilitates absorption of the rain that falls in autumn, winter, and spring. Furthermore, the greatest care is taken to destroy all weeds that appear. Bermuda grass is the most troublesome of these, much of the land suitable for olive culture around Sfax being thoroughly infested with it. As it is advisable to extirpate this weed before the trees are set out, the best results can sometimes be had when planting is postponed until the second year after work on the orchard is begun. The following method is recommended by Minangoin for getting rid of Bermuda grass.

A shallow plowing—to a depth of only 3 or 4 inches—is given with the rude Arab plow, followed by a harrowing, or preferably two cross harrowings. In this way the soil is pulverized and the grass roots are turned up and exposed to the sun and air. On the other hand, a deeper plowing would only bury the rootstocks out of reach of the teeth of the harrow and the shoots would quickly find their way to the surface again. The land is then gone over with a rake—generally the primitive Arab instrument known as the "messaba"—and the rootstocks gathered up by it are burned. A second, somewhat deeper plowing, followed again by the harrow and the rake, is said to be in most cases effective in extirpating the grass.

A different plan requiring much more time and labor, although equally effective, is generally followed by the Arabs. Instead of the plow they use the "maacha" (see fig. 5), an instrument made like a plow, but having in place of a share a flat, thin bar about 2½ feet long, set so that its front edge slants toward the ground and adjustable so as to cut the soil at the desired depth. It otherwise resembles the native plow and is guided in the same way. This implement is passed over the land at intervals of a week or two, especially in summer, but also a few days after every rainfall in winter and spring. The maacha does not remove the roots but is set so as to cut off the grass stems an inch or so below the surface of the soil. As a result the roots, deprived of leaves, finally rot in the ground. It is sometimes necessary to use the maacha a dozen times in rapid succession before the land is clean. The instrument as used by the natives requires a great deal of strength to operate. The driver must stoop and throw the whole weight of his body against the handle bar; but an improved form devised by a French colonist at Sfax can be guided by a man standing erect with his hands on the bar.

The importance attached to getting the land clean is shown by the fact that the "m'rharci" contract (see p. 34) is not considered to have terminated until the Bermuda grass has been extirpated. The extraordinary precautions taken to get rid of this weed show how essential clean culture is considered.

After the land has been cleared of weeds, it is worked less often. To obtain the best results, however, it is necessary to plow at least three times every year, irrespective of the age of the trees. The Arab plow, set to a depth of about 4 inches, is generally used. One authority recommends that the first plowing be given in the winter, immediately after the harvest, in order to loosen the soil that has been trampled down in the processes of harvesting and pruning. The second plowing should take place in spring, after the trees have blossomed, and the third in August or September. Many growers, however, omit the plowing in summer, and on some large plantations only a single plowing is given, soon after the harvest is finished. A marked benefit results if the soil is stirred to a greater depth with a French plow once every two or three years. It is considered advisable, however, not to plow deeper than 10 inches, to avoid injury to the roots of the trees. In addition, the maacha is passed over the land, especially after a rain in winter, as often as is necessary to keep down the weeds and restore the mulch. At least three cultivations a year with the maacha are considered essential. The natives as a rule do all their cultivating with the maacha, using the plow only in preparing the land for seeding to grain.

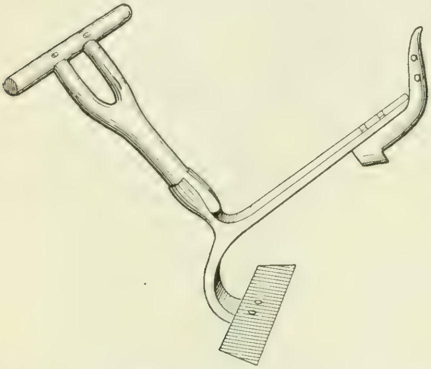

FIG. 5.—The "maacha," the tool used by the Arabs in exterminating Bermuda grass and other weeds. (After Minangoin.)

It is customary during the winter to keep around each tree a shallow basin of the depth reached by the Arab plow. This is at first simply the nearly filled up hole in which the tree was planted, but is extended as the tree increases in size, so as to be always a little greater in diameter than its spread of foliage.

In summer the ground is cultivated up to the bases of the trees, but each autumn the surface of the basins is packed down and made smooth, so as to facilitate gathering the fruit that drops to the ground during the harvest, which would be hard to pick up from plowed ground. The basins also serve the important purpose of catching and holding rain water around the bases of the trees during the winter and spring. In one plantation visited by the writer there were two short, shallow trenches, converging in V-shape, as shown in figure 6, on the uphill side of each tree, which serve to conduct the surface water after rains to the basin around the tree.[a]

The suggestion was made to the writer by a French tenant on one of the new olive orchards near Sfax that the rain which falls upon the surface of the orchard could be better utilized if only an area around each tree corresponding in extent to that occupied by its roots were cultivated, leaving a strip of smooth, unplowed ground between each two neighboring trees. The water falling on the latter would run off the hard ground between into the cultivated areas around the trees. As a result of the existing practice of keeping the entire surface of the orchard cultivated, all the water is absorbed where it falls, and in the middle of the spaces between the trees, at least while the latter are young, sinks into the ground without reaching their roots. After the trees have reached their full growth, however, it is probable that their root systems occupy practically the entire area of the orchard.

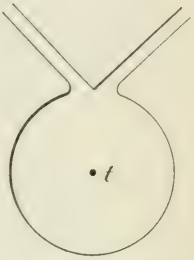

FIG. 6.—Diagram illustrating a method of conducting surface water to the base of an olive tree (*t*).

Until the olive trees begin to bear a considerable quantity of fruit, i. e., usually until they are about ten years old, field crops are frequently grown among them, but after that time, and sometimes after the sixth year, all such crops are rigorously excluded. Barley is the crop that is most often grown in the young orchards, although wheat and horse beans (*Vicia faba*) are also grown. All these are fall-sown crops. Wheat is a more uncertain crop than barley at Sfax and is thought by the natives to draw more heavily on the scanty supply of moisture in the soil. Even barley, though sown every year, can be counted upon to give a good crop only once in three years. In some orchards barley and horse beans are grown in rotation.

From the outset, however, strips of ground 10 to 12 feet wide, in the center of which are the rows of trees, are left absolutely bare. These are widened and the area devoted to small crops is proportionately diminished each year until the olives begin to bear, when the land is left entirely to the trees.

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[a] The same practice obtains also in western Algeria. See Trabut, L., L'Olivier, Bul. 21, Serv. Bot. Gouvernm. Gén. de l'Algérie, 1900, p. 41.

MANURING.

Chemical fertilizers are not used at Sfax, and even the application of barnyard manure is rather the exception than the rule, although it is admitted that a marked increase of yield can be obtained by this means. Domestic animals are few in the Sfax region, and in the extensive orchards recently planted by the French on the edge of the olive-growing district manure is often almost unobtainable. Some of the richer natives who own the older orchards near the town are better situated in this respect.

The first application of manure is said to be generally given when the trees are 10 to 12 years old, and thereafter is repeated every four or five years at the rate of 100 to 200 pounds to the tree. The manure is buried near the foot of the tree, the following method of putting it in being recommended by the manager of one of the large French plantations: A trench about 6 feet long, 2 feet wide, and 2 feet deep is dug on the uphill side of the tree, about 6 feet distant from its base, and is filled with well-rotted mixed barnyard manure. Formerly the manure was buried around the tree at its very foot, a practice that frequently injured the bark of the crown.

PRUNING.[a]

One can not visit the older olive orchards around Sfax without being impressed by the symmetry of the trees and the uniformity in size and shape of their tops. This regularity is due to the great care that is given to the matter of pruning. Certain of the natives who are adepts at this work and can prune on an average eight or ten trees a day receive 60 cents a day for their services. The cost of pruning is partly and sometimes fully covered by the value of the wood removed in the process, firewood being scarce and dear in that region. The larger branches are removed with a saw and the smaller ones with a pruning hook, care being taken to make clean sections.

From the time the trees are three years old until they begin to bear they are trimmed a little every year, just enough to give them the proper shape. Severe pruning of the young trees is avoided, as it interferes with the proper development of the root system, upon which so much depends in the dry climate of Sfax. During the first two or three years it is considered inadvisable to prune the root shoot that has been selected to form the trunk, as otherwise it will grow up rapidly into a spindling, little-branched stem. When the tree is three years old the terminal shoot is cut off, and the first four branches below it are allowed to develop, all branches farther down the stem being suppressed (fig. 7). It is said that bearing commences on an average two years earlier when the terminal shoot is removed than when it is allowed to remain. The removal of the apex of the stem causes the four branches that are left just below it to ascend obliquely instead of spreading horizontally. The year following the tips of these four branches are in turn removed and all but one of their lateral twigs are cut back (fig. 8). During the fifth year new twigs begin to shoot out from the buds on the stumps (fig. 9) and the young tree begins to assume definite form.

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[a] Much of the information contained in this section is taken from Minangoin, N., L'Olivier en Tunisie, Tunis, 1901, a publication that has been freely consulted in preparing the chapters on cultural methods.

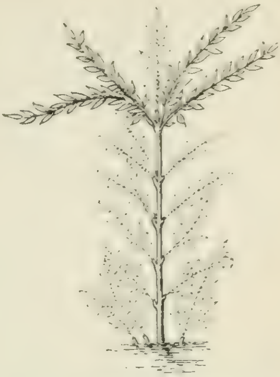

FIG. 7.—Sketch showing the proper form to give in pruning a three-year-old olive tree. The dotted lines indicate the branches that are removed. (After Minangoin.)

The pruning is directed so as to secure a symmetrical, well-rounded top (Pl. I and Pl. IV, fig. 2) with the leading branches at regular intervals and rather far apart. Care is taken to prevent the tree from becoming so tall as to make harvesting difficult, the ideal being a height that equals the spread of the foliage. The inner branches are kept well thinned out, so as to insure the access of as much light as possible to all the fruit-bearing twigs. The rapidly growing erect shoots, which absorb much of the sap of the tree and bear little or no fruit, are removed, except those that are destined to become the main branches. Branches growing in a horizontal direction or inclined to droop at the end are favored. The yield largely depends upon the attention given to these points. The superiority in size of trees and the greater magnitude and regularity of yield shown by the Sfax orchards as compared with those of other parts of Tunis are largely attributed to the care with which the pruning is done.

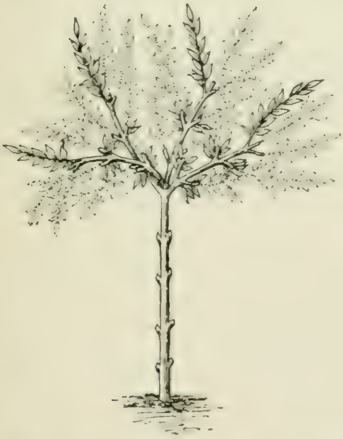

FIG. 8.—The tree shown in figure 7 as pruned when four years old. (After Minangoin.)

When the trees begin to bear, biennial pruning is generally substituted for annual, and the operation is usually performed immediately after the harvest, in January or February. On some plantations, however, the trees are pruned lightly every year, and this is said to insure larger yields year in and year out and to cause less injury to the trees. In annual pruning, the custom is to prune lightly after a small crop in order to secure a heavy crop the season following. After a good crop a thorough pruning is given, as the same tree will not yield heavily two years in succession.

HARVESTING.

Olives commence to ripen at Sfax in October, those borne by the youngest trees being the first to mature. The harvest ordinarily begins in the latter part of October and lasts until the end of January, but when the crop is unusually heavy it sometimes continues until March or even April. The fruit is mostly sold on the tree, the buyer taking charge of the harvest. In this, as in all operations connected with olive growing, greater care is taken at Sfax than in most olive-producing regions. The harvester by means of a double ladder (see Pl. I, frontispiece) is able to gather most of the fruit by hand. The use of a pole is avoided as far as possible, since the olives are likely to be injured by bruises when knocked off. Moreover, many of the young twigs, which are to bear the crop of the following year, are destroyed when this method is followed. In pruning, the importance of making every part of the tree as accessible as possible to the harvester with his ladder is taken into consideration.

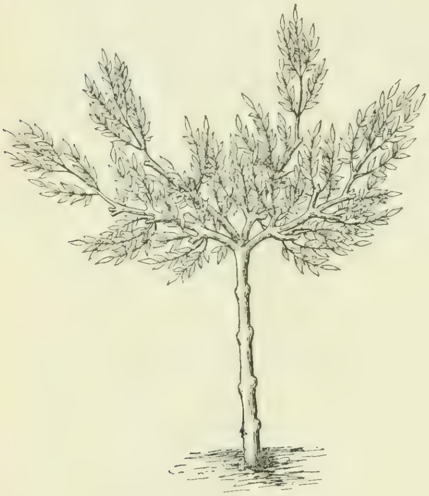

FIG. 9.—The tree shown in figures 7 and 8 as it appears when five years old. (After Minangoin.)

The natives are very dexterous in gathering the fruit, holding the branch with the left hand and stripping it with the right, three fingers of which are armed with the tips of rams' horns, worn like thimbles. The fruit is stripped off into a basket which is fastened to the ladder. When full, the basket is lowered to the ground by means of a cord. It is then emptied by the women upon pieces of cloth or matting, and the fruit is freed from the débris of leaves, twigs, etc., mixed with it. Finally the olives are packed into large panniers, two of which make up a camel load (450 pounds). In the evening or very early in the morning these baskets are loaded upon camels and are thus transported to the factory. When received there they are placed in shallow cement tanks without covers and are left exposed to the weather for three or four days. This renders them soft and permits the extraction of the oil with much less pressure than is required when freshly gathered fruit is put into the presses.

The olives are sold both in the orchard and at the factory at so much the "kafliz," an Arab measure containing about 136 gallons. The ordinary price paid per kafliz at the factory is $13 to $15, which is an advance of 10 to 20 per cent on that paid for fruit on the tree. The price of a kafliz of olives varies as much as $4 during a single season. In 1899 it rose to $20, and even $22, at the factory.

YIELDS OBTAINED.

The rapidity with which the orchards come into bearing depends largely upon the thoroughness of the cultivation given them and the degree of skill used in pruning. While well-tended trees sometimes bear a little when only 3 years old, neglected trees do not begin to yield until they are 12 or 15 years old. As a rule it is eight to ten years from the time of planting before any considerable quantity of fruit is produced. Well cared for trees that are 10 years old are considered to be worth $3 to $3.50, the value increasing to from $5.70 to $7.60 for trees 15 years old and from $9.50 to $13.30 for trees 25 years old. When they reach the age of 25 years the trees are generally in full bearing. According to one authority, however, the yields continue to increase up to the age of 40 years. Minangoin[a] gives the quantities of fruit and of oil from trees of different ages as follows:

TABLE IV.—*Average yields of fruit and of oil from olive trees of different ages in the orchards of Sfax.*

Age of tree.	Yield of fruit.	Yield of oil.	
		Percentage of weight of fruit.	Absolute quantity.
Years:	*Gallons.*	*Per cent.*	*Gallons.*
8	5.3	15	0.8
10	10.6	15	1.6
15	15.9	20	3.2
20	21.2	25	5.3

It is evident from the data given in Table IV that not only the total yields of fruit and oil but the percentage of oil to fruit by weight increase rapidly with the age of the tree. When 25 years old, the average yield of oil per tree is about 6 gallons. Some individual trees attain a production of over 50 gallons of fruit, but such heavy bearers are said to constitute not more than 1 or 2 per cent of the Sfax orchards.

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[a] Minangoin, N. Culture de l'Olivier * * * dans le Centre de la Tunisie. Tunis, 1900, p. 16. In the original the quantities are of course given in liters, not gallons.

After the trees have come into full bearing their yields are said to remain stationary until they are 50 years old, when their productiveness begins to decline. When 80 years old the yields are said to diminish and become very irregular, dwindling to almost nothing in trees a hundred years old. If thoroughly pruned, cultivated deeply enough to lay bare the roots, and well manured, however, old trees can again be brought into bearing.

The crop at Sfax from trees over 20 years old is said to be worth on an average about $2, although sometimes attaining from $3 to $4 per tree. It must be remembered, however, that there are only seven to ten trees to the acre.

It is instructive to compare the yields given in Table IV with those obtained in other olive-growing countries. Thus, in Provence, in southern France, well cared for trees in full bearing are said to produce an average of only 3.9 to 5.3 gallons of fruit, which, if we take the percentage of oil to be about half what it is at Sfax, would give about 0.6 gallon of oil. Hence, although in Provence the trees are planted only 33 feet apart, which allows about 60 to the acre when in squares and 70 when in quincunx, the yield of oil to the acre from well-tended orchards would still fall short of that at Sfax.

The olive is markedly periodic in its bearing and will not produce two heavy crops in succession, no matter how favorable the climatic conditions may be. At Sfax the rule is said to be that if a tree yields heavily one season it will give a medium crop the second and a light crop the third season following. Different trees yield heavily in different years, so that every year some trees are giving their maximum crop.

In January, 1900, there were in operation at Sfax 28 oil mills operated by steam power and 48 native mills operated by animal power. There were 15 mills controlled by Europeans and equipped with modern machinery. The total number of presses was 155, of which 56 were run by steam and 99 by animal traction.

RELATION OF RAINFALL TO YIELDS.

It is interesting to compare the amount of rainfall with the character of the olive crop at Sfax during each of a series of years, such a comparison being given in Table V and being shown also in figure 10.

TABLE V.—*Yearly rainfall and olive production at Sfax in the years 1895 to 1904, inclusive, the latter being indicated by the exports of olive oil from the port of Sfax during each following year.*

Year.	Total rainfall.	Olive crop of the year.[a] Quantity.	Olive crop of the year.[a] Proportion of the average yield.
	Inches.	*Gallons.*	*Per cent.*
1895	3.18		
1896	10.53	627,989	94.0
1897	12.92	706,625	106.0
1898	6.75	983,360	148.0
1899	5.57	523,258	78.5
1900	4.13	612,711	92.0
1901	7.93	253,120	38.0
1902	4.58	1,022,980	153.5
1903	5.26	591,985	89.0
1904	6.77	666,386	100.0
Average for 10 years	6.44	665,368	100.0
Normal for 16 years	9.55		

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[a] It should be noted that the statistics of exports do not discriminate between oil produced by the crop of the preceding autumn and that of two years previous, some part of which is sometimes held in reserve at Sfax if the market be dull. However, a comparison of the average prices of olive oil at Marseille with the volume of the annual exports from Sfax furnishes no evidence that the price is the chief factor in determining the quantity exported each year. It is also uncertain to what extent the coming into bearing of the recently planted orchards may affect the figures, although presumably the addition thus made to the total production has been a gradual one and not likely to cause marked fluctuations. In the main, therefore, it is believed that the above figures are fairly representative of the annual crop. To arrive at the total annual production of oil by the Sfax orchards we must add to the figures in the column showing quantity produced, 531,700 gallons, representing the average amount that is consumed locally or shipped overland to other parts of northern Africa. This is said to vary little from year to year.

Although the records do not cover a sufficiently long period to establish a definite relation, it would appear that there is some connection between the size of the crop and the amount of rainfall of the preceding year or years, but not that of the spring preceding the ripening of the crop. Thus, the comparatively heavy rainfall (3.6

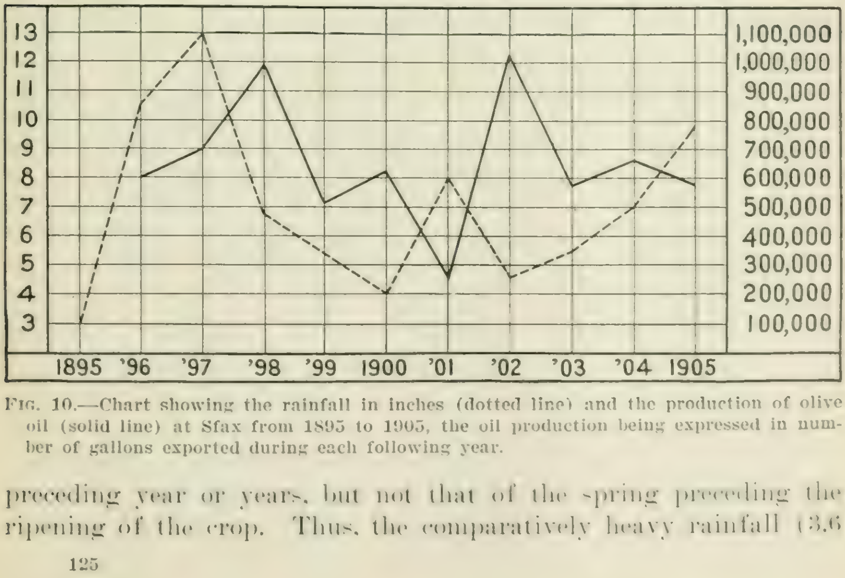

FIG. 10.—Chart showing the rainfall in inches (dotted line) and the production of olive oil (solid line) at Sfax from 1895 to 1905, the oil production being expressed in number of gallons exported during each following year.

inches above the normal) in 1897 doubtless had something to do with the large crop of 1898, although the total rainfall of the first five months of the latter year was less than half of the normal. Again in 1901, when the crop was less than half the average of nine years, the rainfall for the first five months was not greatly below the normal, but that of the year previous was less than half the normal, and during the three years previous the annual rainfall was only a little more than half the normal. It is noteworthy that in 1900, after two years of rainfall much below the normal, the crop was about an average one. This was probably due to the heavy rainfall of November, 1899, which was more than three times the normal for that month, while the precipitation during the first five months of the year in which the crop was made was less than 40 per cent of the normal.[a]

That successful olive culture without irrigation is possible with even a smaller rainfall than the normal for Sfax is indicated by the fact that the oil production of 1903 was only a little below, and that of 1904 was slightly above, the average, although following periods of five and six years, respectively, during which the total annual rainfall was only about 60 per cent of the normal.[b]

LABOR.

While some of the French owners of olive orchards near Sfax manage their own plantations directly or through foremen, the majority have found it more convenient, and until very recently more economical, to follow the practice of the native proprietors and enter into contracts with tenants, or "m'rharcis." The latter are natives more or less skilled in olive culture who undertake the planting and care of the trees. It was formerly customary to terminate the agreement between the proprietor and the m'rharci when all gaps in the orchard had been filled by replanting, all Bermuda grass had been extirpated, and the trees were beginning to bear, which was generally accomplished eight years after the planting. It is now more usual to continue the agreement until the trees begin to bear sufficiently to pay the current expenses of the orchard. i. e., for about ten years. At the expiration of the contract the m'rharci receives in remuneration for his services one-half of the area planted. This arrangement has the advantage of retaining in the neighborhood a number of skilled laborers upon whom the proprietor can generally depend for the care of his part of the trees after the contract has terminated.

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[a] After this bulletin was in type, a report was received that the total exports of olive oil from Sfax in 1906 (crop of 1905) amounted to 592,000 gallons, which was below the average for the preceding ten years. This is doubtless to be explained by the small rainfall of the years 1902 to 1904, which averaged only about 60 per cent of the normal. On the other hand, the total rainfall in 1905 was 9.9 inches.

[b] This may have been partly due, however, to the rapid extension of the orchards during the past twenty years having begun to make itself felt through the increase in the number of bearing trees. It is to be regretted that no data are available which would throw light on the influence of this factor as compared with that of annual variations in the rainfall.

The division of the trees between the proprietor and the m'rharci is made by drawing lots, under the supervision of the amins, who act as agricultural magistrates, and whose duty it is to settle disputes between employers and employees.[a] It is said that the amins, although themselves always natives, are generally fairly impartial in regulating differences between Europeans and their m'rharcis. The proprietor generally seeks to have the plantation divided in such a way that the holdings of his former tenants will be scattered among his own. Many of the m'rharcis prefer, however, to receive money for their share of the trees.

At the beginning of the contract a sum amounting generally to 30 or 40 cents for each tree is advanced by the proprietor, to be used by the m'rharci in purchasing the necessary animals, tools, etc. The loan, which bears no interest, is repaid when the agreement ends, usually in trees from the m'rharci's share. The proprietor furnishes the land, while the m'rharci contributes the truncheons that are planted, the tools and animals used, and all the labor required in clearing, planting, and cultivating. A single m'rharci generally plants and cares for from 150 to 300 trees, while if he has a family to aid him he can sometimes handle as many as 600. He requires one camel for plowing and cultivating every 25 acres. The entire product of the field crops grown in the orchard during the first few years is the property of the m'rharci, unless, as often happens, the proprietor furnishes one-third of the seed used, in which case he is entitled to from one-fourth to one-third of the crop. It is estimated[b] that under this system it costs about $1.40 per tree to set out an olive orchard and care for it until it is 10 years old.

Until recent years, decidedly better results were obtained under the contract system above described than when the proprietor directly or through a European foreman undertook to establish an orchard; but the former method is becoming every year more expensive. Many of the best native growers now have trees of their own to care for and are no longer willing to bind themselves out as m'rharcis. The m'rharci no longer finds on the land to be planted an abundance of old trees from which truncheons can be obtained, and these must frequently be purchased for him by his employer. Furthermore, the m'rharci now expects his employer to advance him 40 cents or more instead of 20 to 30 cents per tree at the beginning of the contract.

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[a] See Bul. 92, Bureau of Plant Industry, p. 32.

[b] Minangoin, N. L'Olivier en Tunisie, Tunis, 1901, pp. 59 and 68.

But, notwithstanding the increasing expense, the contract system still has decided advantages. Europeans who have planted and cared for orchards by hiring laborers under their direct supervision rather than by contracting with a m'rharci have generally found their expenses heavier and the work—especially that of getting rid of weeds—less efficiently done. Besides, they lose the advantage of having around them, when their trees begin to bear, a number of their former m'rharcis, skilled and trustworthy men with whom they have been accustomed to deal and who are usually willing, for moderate wages, to continue the cultivation of their old employer's orchard as well as of their own.

Some of the large plantations belonging to nonresident Europeans are managed by a French agent or foreman under contract for a certain period (generally ten years). He receives a small salary ($30 or $40 a month) and is entitled, at the expiration of his contract, to a certain percentage—usually one-eighth or one-tenth—of the land planted in olives. He in turn either hires laborers or else contracts with native tenants or m'rharcis for the planting and cultivation of the orchard. It is said that an orchard established under the supervision of a competent foreman will yield sufficient fruit after eight years to pay all or most of the running expenses.

The cultivation of the orchard after the m'rharci contract has expired is carried on either by reengaging the m'rharci, in which case he receives one-third or one-half of the crop produced, or else by hiring day laborers. In the latter case it usually costs the owner 18 cents per tree annually to have the cultivation and pruning done. If paid by the day, a laborer earns from 40 to 50 cents when engaged in cultivating or plowing. With a camel he can plow 2½ acres in two or three days and can cultivate the same area with a "maacha" in one day. For pruning, which requires special skill, a man receives about 60 cents a day. The crop, as we have seen, is generally gathered under contract by the purchaser, the harvesters being usually paid with a share of the fruit.

UTILIZATION OF THE RUN-OFF IN OLIVE CULTURE IN OTHER PARTS OF TUNIS.

Olive orchards occupy large areas in northern Tunis, notably in the neighborhood of the capital itself and in the valley of the Mejerda, the principal river of Tunis. In this region the annual rainfall[a] is sufficient for olive production without any special measures being taken to conserve the soil moisture. The olive is also an important tree in some of the oases of southern Tunis, where the scantiness of the rainfall [a] is compensated for by the abundant supply of water from springs that is available for irrigation.

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[a] The average annual rainfall at the city of Tunis is 18.8 inches.

But in one of the most important olive-producing regions in Tunis, i. e., that surrounding Susa [b] on the eastern coast, the normal annual rainfall of 16.6 inches, although greatly exceeding that at Sfax, is yet so small as to make it worth while to employ a special method for utilizing it to the fullest possible extent. This method is very different from that used at Sfax, and in its way is almost equally interesting. The country around Susa is very hilly, being divided by limestone ridges into small valleys and ravines. The bottoms of these valleys and the lower slopes, which are made sufficiently level for the purpose by a system of terracing, are occupied by small basins, separated one from another by low banks of earth. Each basin contains a few olive trees, usually only from two to eight. The stony upper slopes and summits of the ridges, which produce a scanty natural growth of shrubs and grasses, are not cultivated. At intervals along these slopes, or "meskas," as they are termed by the Arabs, are shallow trenches running obliquely toward the bottom. These are so arranged as to catch and conduct to the basins as much as possible of the rain water that falls upon the slope. The owner of each orchard has a recognized right to all water that falls upon the slopes adjacent to his property. The basins are said often to remain filled with water during the month of January.

The heavier texture of the soil around Susa as compared with that at Sfax is favorable to this method of irrigation by rainfall, as it permits the water to flow from basin to basin, instead of being all quickly absorbed in the first one. It is generally observed in this region that olive orchards that are watered by the rain that falls on the "meskas" give larger and especially more regular yields than those receiving only direct rainfall.

From the nature of the case, accurate alignment and widely distant planting of the trees as practiced at Sfax are out of the question at Susa. The trees stand comparatively close together, so that there are often forty to the acre instead of only seven to ten, as at Sfax. Much less care is taken to cultivate the soil, and this also is more or less inevitable from the nature of the ground; but there seems to be no good excuse for the small attention that is paid at Susa to pruning, as compared with the thoroughly scientific way in which this operation is performed in the Sfax orchards.

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[a] The normal annual rainfall in the oasis of Gafsa is 8.5 inches; in that of Gabes, 7.6 inches; in that of Tozer, 5.1 inches. In the oasis of El Oudiane, 9 miles distant from Tozer (see Bulletin 92, Bureau of Plant Industry, p. 16), there are 25,000 olive trees, with an average yearly production of 132,000 gallons of oil.

[b] Susa, better known by its French name of Sousse, is about 70 miles southeast of Tunis and about an equal distance north of Sfax.

Many of the trees have several trunks, which is explained by the natives as having been due to a violent storm, which a century ago laid low most of the olive trees around Susa, after which event several shoots at the base of each tree were allowed to spring up.[a] The greater part of the olive trees around Susa are of great age, often 100 or 150 years old, it is said. But when well cared for with respect to cultivation of the soil, pruning, and manuring, even these old trees are reported to give good returns, netting the owners in some years as much as 95 cents to the tree, or $38 per acre.[b]

SUMMARY.

(1) Arboriculture is an important phase of dry-land agriculture and one that has as yet received little attention in the United States.

(2) The olive, owing to its peculiar leaf structure and to the character of its root system, is especially fitted for growing in regions where the rainfall is slight and irrigation is impossible.

(3) Fifteen hundred years ago the olive was grown without irrigation under a rainfall of from 8 to 14 inches over an extensive region in northern Africa, the prosperity of which in Roman times depended chiefly upon its production of olive oil. A vast region that is now practically an uninhabited desert was then covered with olive orchards and with flourishing cities and towns.

(4) During the last hundred years much progress has been made in reestablishing dry-land olive culture in southern Tunis. There are now nearly 500,000 acres of unirrigated olive orchards in the neighborhood of Sfax.

(5) As would be expected from its nearness to the Sahara, the climate of Sfax is almost desert-like. The summers are very hot and the average annual rainfall is only 9.3 inches, sometimes falling below an average of 6 inches for seven consecutive years. As in California, the summer is the dry season and the winter the wet season.

(6) The ground water lies too deep to be reached by the roots of the trees. No water is available for irrigation.

(7) The soil of the Sfax region that is considered best adapted to olive culture is a red loam or fine sandy loam that is fairly uniform in texture to an average depth of seven feet. It is very retentive of moisture, rich in lime and potash, but apparently deficient in nitrogen and phosphoric acid.

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[a] Minangoin, N. L'Olivier en Tunisie, Tunis, 1901, p. 32.

[b] Minangoin, N., l. c., p. 54.

(8) Only one variety of olive, the Chemlaly, a small-fruited oil-producing variety, is extensively grown in the Sfax region. It is a very productive variety and its fruits yield an unusually high percentage of oil.

(9) Wide planting and thorough cultivation are the most important principles of olive culture at Sfax. The trees are planted 65 to 80 feet apart in each direction, giving space for only seven to ten trees to the acre.

(10) The olive is propagated at Sfax by means of large truncheons or pieces of old wood, each containing several buds. These are set to a depth of about a foot in holes, which become gradually filled as the young trees grow up. During the first summer or two, two or three waterings by hand are usually given. All shoots but the best one are trimmed away within three years after setting out the truncheon.

(11) A good dust mulch is always maintained on the surface of the orchard, and weeds, of which Bermuda grass is the most troublesome, are kept down by frequent cultivation. As a rule, the soil is stirred by a shallow plowing three times a year. The most important plowing is the one that immediately follows the harvest. After the trees begin to bear, no other crop is allowed to grow among them.

(12) Great care is taken in the matter of pruning, the trees being given a broad, symmetrical top. The interior branches are thinned out so that plenty of light and air can reach all the fruit-bearing twigs. The comparatively sterile, rapidly growing, erect branches are removed. Skillful pruning is an important factor in the large yields obtained.

(13) The harvesting is done by hand, more than usual care being taken to avoid bruising the fruit or breaking the branches.

(14) After eight or ten years the trees generally yield enough fruit to pay the current expenses of the orchard, and when about 25 years old they are in full bearing. The average yield per tree is then about 24 gallons of fruit, which gives 6 gallons of oil.

(15) There is apparently a relation between the yield of the olive and the rainfall of the previous year, but none between the yield and the rainfall of the year in which the crop is made.

(16) In another part of Tunis, where the rainfall is about 16.5 inches and the country more hilly than around Sfax, the rain that falls on the slopes is collected in trenches and conducted into small basins in which the trees are planted.

PLATES.

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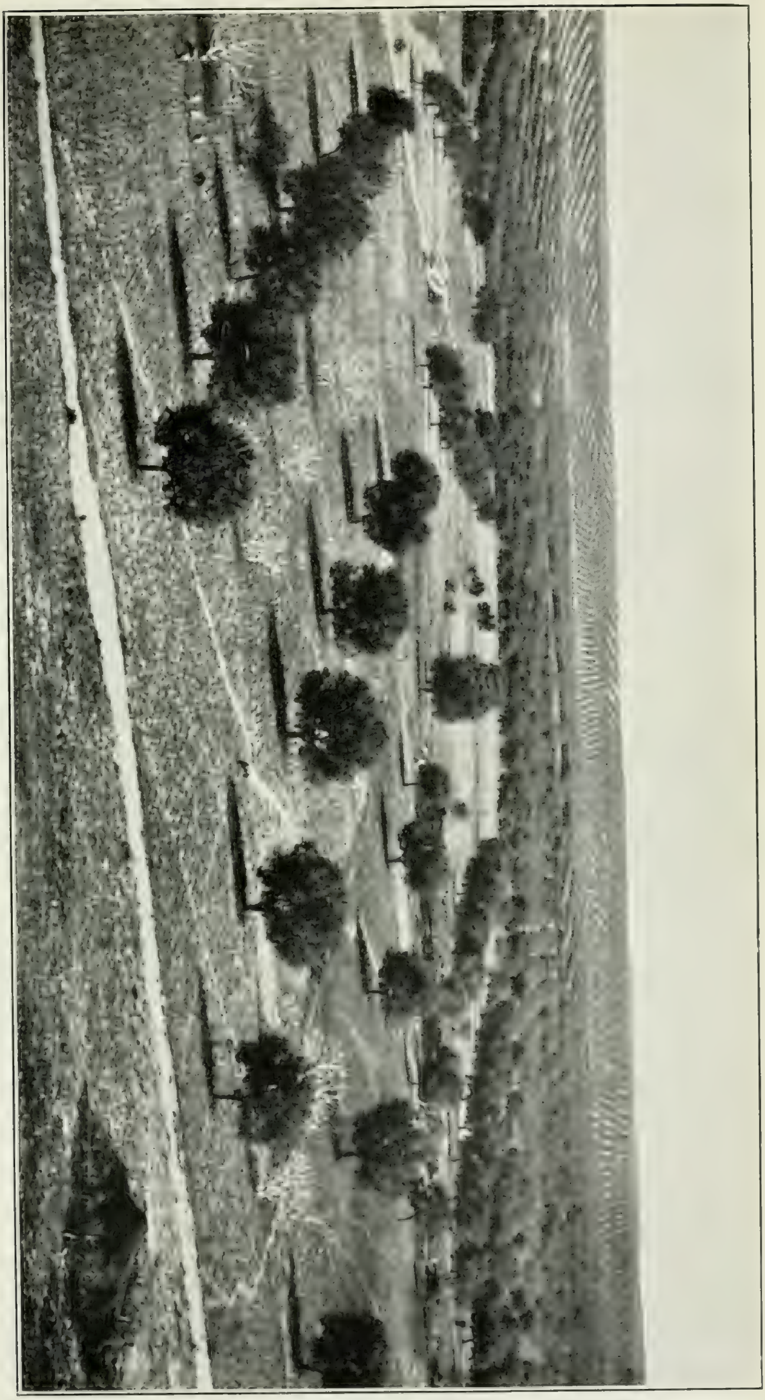
DESCRIPTION OF PLATES.

Plate I. *Frontispiece.* Harvesting Chemlaly olives in a dry-land orchard at Sfax in southern Tunis. Since the quality of the oil is impaired if the fruit becomes bruised, the use of a pole is avoided and the picker uses a ladder to reach the fruit-bearing twigs. Pruning is managed so that every part of the tree can be reached in this way. The native pickers protect their fingers with the tips of rams' horns and can thus strip the fruit off the twigs without injuring their hands. The olives are collected in the large baskets shown in the illustration and are transported by camels to the factory. The plate also shows the clean cultivation of the orchards, the dust mulch maintained on the surface, and the care with which pruning is done.

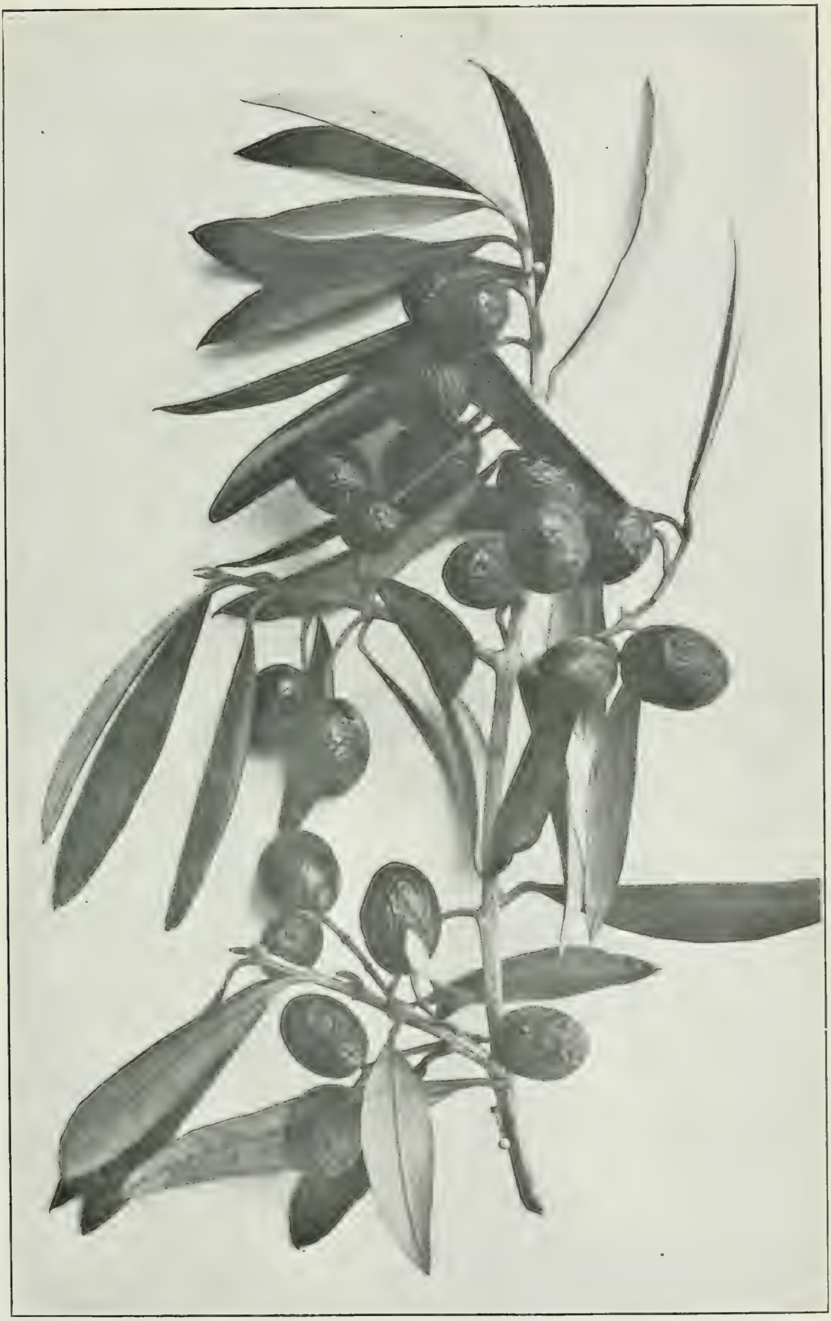
Plate II. General view of the older dry-land olive orchards near Sfax, showing the wide planting and clean cultivation practiced and the uniform shape given the trees by careful pruning. The leafless trees in the foreground are figs, these and other fruit trees being occasionally planted in the olive orchards that belong to natives. (From a photograph furnished by the Direction des Antiquités et Beaux Arts at Tunis.)

Plate III. A fruit-bearing twig of the Chemlaly olive, natural size, from a photograph by M. Minangoin. The fruits of this variety are small but numerous and are very rich in oil. They are jet black when ripe.

Plate IV, Fig. 1.—Recently planted dry-land olive orchards about twenty miles from Sfax. The view shows the careful alignment and wide spacing of the trees, which are 80 feet apart each way and number only 7 to the acre. Most of the trees shown are from ten to twelve years old. The hillside in the immediate foreground and that in the left background are unfit for planting to olives because of the absence of soil, a calcareous rock coming to the surface at these points. Fig. 2.—The interior of an older olive orchard at Sfax, showing the entire absence of weeds, the great distance between the trees, and the well-rounded symmetrical form of the trees due to scientific pruning. These trees are about thirty years old and are in full bearing.



GENERAL VIEW OF THE OLDER DRY-LAND OLIVE ORCHARDS NEAR SFAX.



A FRUIT-BEARING TWIG OF THE CHEMLALY OLIVE.

(Natural size.)

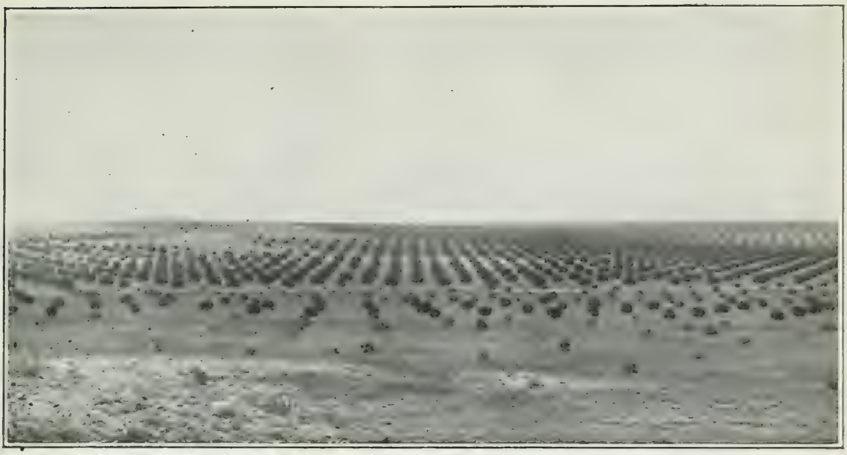


FIG. 1.—RECENTLY PLANTED DRY-LAND OLIVE ORCHARDS NEAR SFAX, SHOWING THE CAREFUL ALIGNMENT AND WIDE SPACING OF THE TREES.

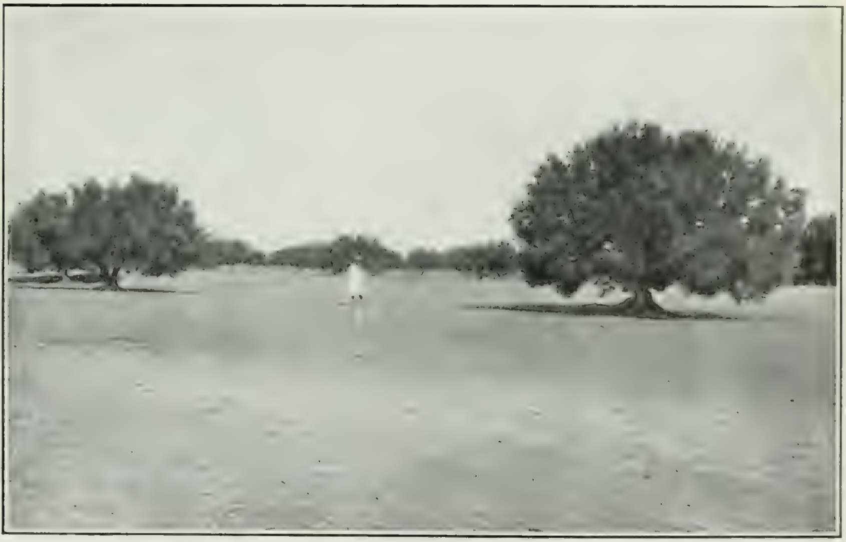


FIG. 2.—THE INTERIOR OF A SFAX OLIVE ORCHARD, SHOWING WIDE PLANTING, CLEAN CULTIVATION, AND CAREFUL PRUNING.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 126.

B. T. GALLOWAY, *Chief of Bureau.*

NOMENCLATURE OF THE PEAR;

A CATALOGUE-INDEX OF THE KNOWN VARIETIES REFERRED TO IN AMERICAN PUBLICATIONS FROM 1804 TO 1907.

COMPILED BY

W. H. RAGAN,

EXPERT IN POMOLOGICAL NOMENCLATURE.

ISSUED JUNE 30, 1908.

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1908.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., December 14, 1907.

Sir: I have the honor to transmit herewith the copy for a bulletin entitled "Nomenclature of the Pear; a Catalogue-Index of the Known Varieties Referred to in American Publications from 1804 to 1907," prepared by Mr. W. H. Ragan, Expert in Pomological Nomenclature.

The manuscript submitted is a nearly complete compilation of the published names of cultivated varieties of pears, accompanied by brief descriptions and histories of varieties, including origin, form, size, color, texture, flavor, quality, and time of maturity.

I recommend that this manuscript be published as Bulletin No. 126 of the special series of this Bureau.

Respectfully,
B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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NOMENCLATURE OF THE PEAR;

A CATALOGUE-INDEX OF THE KNOWN VARIETIES REFERRED TO IN AMERICAN PUBLICATIONS FROM 1804 TO 1907.

INTRODUCTION.

This bulletin is the second (following the already published "Nomenclature of the Apple") in a contemplated series in which it is hoped that the names of all the cultivated fruits will ultimately be published and disseminated for the information of those who are interested in the correct nomenclature of varieties.

In the series to which this belongs no effort is being made to include varieties and descriptions from foreign authors. Foreign writers (other than those of our near-by neighbors of the Canadian Provinces, who are always treated as our own) have published the names of many varieties that are not included in this compilation. It is true, however, that an occasional reference is made to foreign authors as having published names of varieties or as giving descriptions referred to in the following tables in the column devoted to remarks and presented as historical facts. It will therefore be understood that this is purely an American work and that what is to be found in its pages is but the reflex of the literature of the pear as it occurs in publications of American authors and writers.

Many American writers on the names of fruits have acknowledged in varying language and with more or less emphasis that our nomenclature is in a deplorable state of confusion, and each has regretted his inability to accomplish more than a small part of the great task of correcting and simplifying it. This confusion is the result of a combination of causes, of which the greatest has been the enormous expense of such an undertaking and the little promise of pecuniary reward.

Robert Manning, late of Salem, Mass., who established in 1823 the first extensive collection of varieties of fruits, carefully selected and named, in this country and who realized to the fullest extent the importance of correct nomenclature, said in the introduction to his "Book of Fruits," published in 1838:

> The innumerable errors in the names of fruits are inconceivable to any but a collector. It is very desirable that there should be some acknowledged standard, to whose authority in doubtful cases of this nature we might appeal.

Col. Marshall P. Wilder, the long-time president of the American Pomological Society, subsequently said, under the head of "Improved Nomenclature":

> In the future, we desire to use but one word for the name of a fruit, as with the Baldwin apple, the Bartlett pear, the Concord grape, and other renowned fruits, which will be perpetually known by appropriate and easily remembered names. In a word, we desire to establish a system of nomenclature which shall be pure and plain in its diction, pertinent and proper in its application, and an example not only to our own but to other countries; to strike off the hundreds of Beurres and Doyennes from the names of our pears where it is possible to do so, and to write hereafter Anjou, Diel, and Boussock in the place of Beurre d'Anjou, Beurre Diel, Doyenne Boussock, etc.

The necessity for such an improved system of nomenclature has grown with the multiplication of varieties and the increasing importance of our fruit industries. In the hope of supplying this "improved system of nomenclature" the Bureau of Plant Industry of the United States Department of Agriculture, in cooperation with the American Pomological Society, is now laboring to facilitate the reform so earnestly desired by Mr. Manning and Colonel Wilder, and by all true pomologists of subsequent time.

Among our standard fruits the pear in many of its characteristics ranks next in importance to the apple, and is therefore made the subject of this publication. In collecting data for its foundation no pains have been spared to make it as complete and as reliable as possible. A careful and painstaking search of the American literature of the pear, extending back to and including the publication of the Domestic Encyclopedia in 1804, enables us to present a fairly complete synonymy of its nomenclature, embracing both leading names and their synonyms. These have been arranged in alphabetic order and with special reference to ease and facility in determining any and all questions which may arise in connection with the nomenclature of the pear.

As in the preparation of the apple bulletin, the code of nomenclature of the American Pomological Society has been followed in the naming of varieties. This code, as already indicated in the quotation from Colonel Wilder and in common with the tendency of the times, inclines toward ease and simplicity in varietal nomenclature, and when applied to the pear has led to many changes, which will be clearly apparent to the student of pomology. A large percentage of our cultivated pears originated in foreign countries and have come to us with names which are generally long and difficult of pronunciation, especially by the uneducated tongue, and abound in superfluous prefixes, suffixes, and meaningless verbiage. The rules cited authorize their simplification, and this authority has been freely availed of in the preparation of this bulletin, though in all cases in which changes have been made the original name appears in its proper place as a synonym, so that the student will have no difficulty in tracing the name to its source and also in determining by means of citations the authority for making the change.

It is not claimed that all names that appear in this catalogue as leading names represent distinct varieties, as it has often been impossible to determine from the meager information obtainable that such is the case. All names that have been found in an exhaustive search of the literature of the pear, conducted as preliminary to the completion of this work, are included in its pages. Concerning some of these no reliable information has been found, and of course they are only given as names that have been published (the citations always tell where) for what have been claimed to be distinct varieties. Many of these will probably prove to be worthless seedlings or old and already named sorts, along with which they must ultimately take their place as synonyms.

Some instances will be found in which one name has long been applied to two or more distinct varieties which it may not now be advisable to change. In almost all such cases a "distinguishing term" is used to designate the one from the other, as in "Jargonelle (Eng.)," "Jargonelle (Fr.)," "Bon Chretien (Sum.)," "Bon Chretien (Win.)," etc. (See Rule 1 of the Code.) Leading names are printed in black-faced type and synonyms in italics.

In order that the Code of Nomenclature may be fully understood and appreciated, its complete text is herewith presented:

CODE OF NOMENCLATURE OF THE AMERICAN POMOLOGICAL SOCIETY.

(Adopted at Boston, September 10, 1903.)

PRIORITY.

RULE 1. No two varieties of the same kind of fruit shall bear the same name. The name first published for a variety shall be the accepted and recognized name, except in cases where it has been applied in violation of this code.

A. The term "kind" as herein used shall be understood to apply to those general classes of fruits which are grouped together in common usage without regard to their exact botanical relationship, as apple, cherry, grape, peach, plum, raspberry, etc.

B. The paramount right of the originator, discoverer, or introducer of a new variety to name it, within the limitations of this code, is recognized and emphasized.

C. Where a variety name through long usage has become thoroughly established in American pomological literature for two or more varieties, it should not be displaced nor radically modified for either sort, except in cases where a well-known synonym can be advanced to the position of leading name. The several varieties bearing identical names should be distinguished by adding the name of the author who first described each sort, or by adding some other suitable distinguishing term which will insure their identity in catalogues or discussions.

D. Existing American names of varieties which conflict with earlier published foreign names of the same or other varieties, but which have become thoroughly established through long usage, shall not be displaced.

FORM OF NAMES.

RULE 2. The name of a variety of fruit shall consist of a single word.

A. No variety should be named unless distinctly superior to existing varieties in some important characteristic, nor until it has been determined to perpetuate it by bud propagation.

B. In selecting names for varieties the following points should be emphasized: Distinctiveness, simplicity, ease of pronunciation and spelling, indication of origin or parentage.

C. The spelling and pronunciation of a varietal name derived from a personal or geographical name should be governed by the rules which control the spelling and pronunciation of the name from which it was derived.

D. A variety imported from a foreign country should retain its foreign name, subject only to such modification as is necessary to conform it to this code or to render it intelligible in English.

E. The name of a person should not be applied to a variety during his life without his express consent. The name of a deceased horticulturist should not be so applied except through formal action by some competent horticultural body, preferably that with which he was most closely connected.

F. The use of such general terms as seedling, hybrid, pippin, pearmain, beurre, rare-ripe, damson, etc., is not admissible.

G. The use of a possessive noun as a name is not admissible.

H. The use of a number, either singly or attached to a word, should be considered only as a temporary expedient while the variety is undergoing preliminary test.

I. In applying the various provisions of this rule to an existing varietal name which has through long usage become firmly embedded in American pomological literature, no change shall be made which will involve loss of identity.

RULE 3. In the full and formal citation of a variety name, the name of the author who first published it shall be given.

PUBLICATION.

RULE 4. Publication consists (1) in the distribution of a printed description of the variety named, giving the distinguishing characters of fruit, tree, etc., or (2) in the publication of a new name for a variety which is properly described elsewhere; such publications to be made in any book, bulletin, report, trade catalogue or periodical, providing the issue bears the date of its publication and is generally distributed among nurserymen, fruit growers, and horticulturists; or (3) in certain cases the general recognition of a name for a propagated variety in a community for a number of years shall constitute publication of that name.

A. In determining the name of a variety to which two or more names have been given in the same publication, that which stands first shall have precedence.

REVISION.

RULE 5. No properly published variety name shall be changed for any reason except conflict with this code, nor shall another variety be substituted for that originally described thereunder.

ARRANGEMENT OF THE CATALOGUE-INDEX.

All names and synonyms of varieties are arranged alphabetically and each name or synonym is immediately followed by citations of American authors or publications in abbreviated form that have used the same, and, as far as possible, these citations appear in the chronological order of their publication; viz, the first American publisher of the name or synonym, as the case may be, appears first in its order of citation, and so on to the end. Different editions by a given author and serial publications are indicated by the number of the volume, the date of the copyright, or the year of the publication. In the case of standard publications, the date of the copyright, when ascertainable, has always been given the preference.

Immediately following these citations and in the case of leading names will be found all known synonyms, and after a synonym its true name. Thus, "Sickel. D'45,415,'57,443,'69,852. T'75,555, '85,570,'97,714. Syn. of Seckel" means that Downing and Thomas in their several editions and on the pages cited have published "Sickel" as a synonym of "Seckel." Through this order of publication and citations the reader will be enabled to find the variety and what may be said of it in any publication in which it has appeared and which has been discovered in our search for names, and thus this bulletin will prove to be a fairly complete index to the American literature of the pear.

Following the publication of varieties and their citations will be found a tabular and abbreviated form of descriptions that will aid greatly in conveying a correct understanding as to their leading characteristics, including origin, time of ripening, etc., together with a column for remarks in which many additional facts are briefly presented.

ABBREVIATIONS USED IN DESCRIPTIONS OF VARIETIES.

The following abbreviations are used in the descriptions of varieties:

Origin: Amer., America; Eur., Europe; Eng., England; For., Foreign; Fr., France; Mass., Massachusetts; N. Y., New York, etc.

Form: a, acute; f, flat; obl, oblong; obo, obovate; obt, obtuse; ov, ovate; p, pyriform; r, round; t, truncate.

Size: l, large; m, medium; s, small; vl, very large; vs, very small.

Color: b, blushed; br, brown; c, cinnamon; g, green; r, red; ru, russet; s, striped; w, white; y, yellow.

Texture: b, buttery; c, crisp; co, coarse; d, delicate; g, gritty; j, juicy; m, melting; t, tough.

Flavor: a, acid; sa, subacid; p, perfumed; s, sweet; spr, sprightly; v, vinous.

Quality: b, best; g, good; m, medium; p, poor; vg, very good.

Season: e, early; m, medium; l, late; ve, very early; vl, very late.

ABBREVIATIONS USED IN CITATIONS OF AUTHORS AND PUBLICATIONS.

In this catalogue many publications are referred to in abbreviated form. These abbreviations will need to be well understood in order to obtain the best results from the study of its pages. Several classes of publications are referred to. Standard works are usually indicated by a single initial, as "D" for "Downing's Fruits and Fruit Trees of America," and wherever a "D" is found in connection with the date of the edition and number of the page it means that Downing's reference to the variety specified may be found in the edition referred to and on the page mentioned. Trade catalogues, agricultural experiment station bulletins, reports of societies, and periodical and other publications are referred to in a similar manner, each being fully explained in the following list:

ALPHABETIC LIST OF ABBREVIATIONS USED IN DESIGNATING THE PUBLICATIONS QUOTED.

A	Proceedings of the American Pomological Society, 1852 to 1905, inclusive.
ACT	A. Clark Tuttle, catalogue.
ADB	A. D. Barnes, catalogue.
ADF&S	Mrs. A. D. Freeman & Sons, catalogue.
AgR	Reports of the United States Department of Agriculture, 1847 to 1893, inclusive.
AHCC&C	A. H. C. Chadbourne & Co., catalogue.
AHG	A. H. Griesa, catalogue.
AHM	American Horticultural Manual, Part 2, 1903, by Budd and Hansen.
AHortA	American Horticultural Annual, 1868 to 1871, inclusive.
AJC	Arthur J. Collins, catalogue.
AJofH	American Journal of Horticulture, monthly, volumes 1 (1867) to 9 (1871), inclusive.
AlaB	Bulletins of the Alabama Experiment Station, Nos. 30, 98, 106, 112 and 117.
AlaNCo	Alabama Nursery Company, catalogue.
Al&H	Alexander & Hammond, catalogue.
AmAg	American Agriculturist, weekly.
AMassH	Addresses of Massachusetts Horicultural Society.
AMB	Amherst (Massachusetts) Agricultural Experiment Station bulletins.
AmF	American Farmer, monthly, 1820 to 1881.
AmGar	American Gardening, 1883 to 1902.
AndN	Andorra Nurseries, catalogue, 1895.
AN&OCo	Albaugh Nursery and Orchard Co., catalogue, 1894.
AofH	Annals of Horticulture in North America, 1889 to 1893, inclusive.
AP	A. Pullen, catalogue.

APC	Report of the American Pomological Congress, vol. 1, 1850.
ArizB	Bulletin No. 15 of the Arizona Agricultural Experiment Station.
ArkH	Transactions of the Arkansas State Horticultural Society.
ARW	A. R. Whitney, catalogue, 1887.
AS	Special Report of the American Pomological Society. 1904–5.
A&H	Albertson & Hobbs, catalogue.
B	Barry's Fruit Garden, editions of 1851 and 1883, by Patrick Barry.
BBCo	Brown Bros. Co., catalogue, 1892.
BBL	Benjamin Buckman's List of Fruits in Trial Orchard.
Bl	The Culture of the Peach and Pear, edition of 1886, by John J. Black, M. D.
B (Ph)N	Bloomington (Phœnix) Nursery, catalogue.
Bul	Bulletins Nos. 6 and 8 of the Division of Pomology, U. S. Department of Agriculture, 1897 and 1899.
C	A View of the Cultivation of Fruit Trees, edition of 1817, by William Coxe.
CAG	Charles A. Green, catalogue.
CalB	Bulletin No. 147 of the California Agricultural Experiment Station.
CalSBofH	Reports of the California State Board of Horticulture, 1889 to 1902, except 1890 and 1899–1900.
CanExFr	Reports of Canada Experimental Farms, 1894 to 1905, inclusive.
CanH	Canadian Horticulturist, monthly, 1878 to 1905, inclusive.
CB	Bulletins of the Cornell (N. Y.) Agricultural Experiment Station.
CBCo	Chase Brothers Co., catalogue, 1895.
CExFB	Bulletins of the Central Experimental Farm, Canada.
CExFR	Reports of the Central Experimental Farm, Canada, 1894 to 1905, except 1897.
CGen	Country Gentleman, vols. 2 to 26, inclusive.
ChNC	Cherokee Nursery, catalogue, 1893.
CLW	Charles L. Watrous, catalogue, 1897.
CNC	California Nursery Co., catalogue, 1893 to 1895.
C(O)HS	Reports of Columbus (Ohio) Horticultural Society, 1886 to 1904, except 1890 and 1895.
Cole	The American Fruit Book, edition of 1849, by S. W. Cole.
ColH	Transactions of the Colorado State Horticultural Society, 1882 to 1905, with a few omissions.
CtP	Transactions of the Connecticut Pomological Society, 1891 to 1903, inclusive.
Cult	The Cultivator, 1834 to 1865, when the Cultivator was merged into the Country Gentleman.
D	The Fruits and Fruit-Trees of America, editions of 1845, 1857, and 1869, by A. J. and Charles Downing.
Dap	Appendixes 1, 2, and 3 to The Fruits and Fruit-Trees of America, 1872, 1876, and 1881, by Charles Downing.
DomEnc	Domestic Encyclopedia, first American edition, 1804, article on fruits, by Dr. James Mease.
E	Elliott's Fruit Book, or, the American Fruit Grower's Guide, editions of 1854 and 1859, by F. R. Elliott.
EFABC	Catalogue of Fruit Trees on Trial at the Experimental Farm, Agassiz, B. C., Canada, 1900.
EWK	E. W. Kirkpatrick, catalogue, 1894, 1901.
EYT	E. Y. Teas, catalogue, 1872, 1874.
E&B	Ellwanger & Barry, catalogue, 1890, 1894, 1895, 1901, 1902.

F	Pear Culture, edition of 1858, by Thomas W. Field.
FDNCo	Franklin Davis Nursery Company, catalogue.
FEY	Fred E. Young, catalogue.
FF&S	Frank Ford & Son, catalogue.
FGAofO	Reports of the Fruit Growers' Association of Ontario, Canada, 1882 to 1905, inclusive.
FofO	Fruits of Ontario, edition of 1898, by Linus Woolverton.
FSP	Frank S. Phoenix, catalogue.
F&G	Farmer and Gardener, 1843 (copied by Transactions of the Indiana Horticultural Society, 1882, p. 128).
G	The Northern Fruit Culturist, edition of 1849, by Chauncey Goodrich.
GaH	Proceedings of Georgia State Horticultural Society, 1876 to 1904, with a few omissions.
GarCal	The American Gardener's Calendar, by Bernard M'Mahon, 1806.
GarM	Gardeners' Monthly, 1859 to date, with omissions.
Gb	Nomenclature of our Russian Fruits, edition of 1887, by Charles Gibb.
GB	Greening Brothers, catalogue.
GBB	G. B. Brackett, catalogues, 1853, 1868, 1871.
GCR	George C. Roeding, catalogue.
GenF	The Genesee Farmer, 1832, 1833, 1834, 1837, 1838, 1839, 1840, 1841, and occasional numbers later.
GHM&S	George H. Miller & Son, catalogue.
H	Hooper's Western Fruit Book, edition of 1857, by E. J. Hooper.
Ha	Harcourt's Florida Fruits, edition of 1886, by Helen Harcourt.
HAJ	Horticultural Art Journal, monthly, 1886, 1887, 1888, 1889, 1890.
HB	Hand Book for Fruit Growers, editions of 1876 and 1903, by F. R. Elliott.
HB&T	Hoopes Brothers and Thomas, catalogue.
HEH&B	H. E. Hooker & Bro., catalogue, 1873.
HMHS	History of the Massachusetts Horticultural Society, edition of 1880, by Robert Manning.
Hof	Hoffy's North American Pomologist, 1860, edited by William D. Brinckle, M. D.
Hort	The Horticulturist, monthly, 1846 to 1875, inclusive.
Hov	The Fruits of America, in two volumes, edition of 1851, by Charles M. Hovey.
Huc	Huntsville Nursery Company, catalogue.
IaB	Bulletins of the Iowa Agricultural Experiment Station, Nos. 3 and 31.
IaH	Transactions of the Iowa State Horticultural Society, 1867 to 1905, except 1868 and 1870.
IEI	I. E. Ilgenfritz & Sons, catalogues, 1899, 1901, 1902.
IllH	Transactions of the Illinois State Horticultural Society, 1860 to 1905, inclusive.
IndF	Indiana Farmer, monthly, 1840.
IndH	Transactions of the Indiana Horticultural Society, 1861 to 1905, inclusive.
JB	John Bidwell, catalogue, 1893.
JBW&B	J. B. Wild & Bro., catalogue, 1892.
JSC&S	John S. Collins & Son, catalogue.
JSK	John S. Kerr, catalogues, 1891, 1901.
JVL	John Van. Lindley, catalogues, 1893, 1895, 1896, 1899, and 1902.

K	The New American Orchardist, editions of 1832 and 1841, by William Kenrick.
KanH	Transactions of the Kansas State Horticultural Society, 1874 to 1905, except 1876.
KanFM	Kansas Fruit Manual, edition of 1886, by the State Horticultural Society.
L	Name modified by Mr. T. T. Lyon as chairman of a committee of the American Pomological Society.
LaB	Louisiana State Experimental Station, Bulletin No. 22.
M	The Book of Fruits, edition of 1838, by Robert Manning, revised and republished as the New England Fruit Book, by John M. Ives, in 1844 and again in 1847.
MagofH	The Magazine of Horticulture, monthly, 1835 to 1860, inclusive.
MassH	Transactions of the Massachusetts Horticultural Society, 1837 to 1905, with a few omissions.
MdH	Transactions of the Maryland State Horticultural Society, 1898 to 1905, inclusive.
MeP	Transactions of the Maine State Pomological Society, 1873 to 1905, inclusive.
MHSC	Transactions of Montreal (Canada) Horticultural Society, 1876 to 1888, inclusive.
MichB	Bulletins of the Michigan Agricultural Experiment Station, Nos. 31, 104, 105, 177, 187, 194, 205.
MichH	Transactions of the Michigan State Horticultural Society, 1870 to 1903, inclusive.
MichHort	Michigan Horticulturist, monthly, January to December, 1886, inclusive.
MichSB	Special Bulletins of the Michigan Agricultural Experiment Station, Nos. 27, 30, and 35.
MinnH	Transactions of the Minnesota State Horticultural Society, 1874 to 1904, inclusive.
MoH	Transactions of the Missouri State Horticultural Society, 1859 to 1904, except 1874, 1875, 1876, 1877, and 1878.
MVHS	Transactions of the Mississippi Valley (later the American) Horticultural Society, 1883 to 1888, inclusive.
N	Northwestern Pomology, edition of 1894, by C. W. Gurney.
NAPC	Transactions of the North American Pomological Convention, 1849.
NebH	Transactions of the Nebraska State Horticultural Society, 1885 to 1905, inclusive.
NJH	Transactions of the New Jersey Horticultural Society, 1876 to 1906, inclusive.
NSFG	Transactions of the Nova Scotia Fruit Growers' Association.
NWC	N. W. Craft, catalogue.
NWFG	Transactions of the North Western Fruit Growers' Association, 1851, 1852, 1855.
NYC	New York Agricultural Experiment Station Circular, 1890.
OH	Transactions of the Ohio State Horticultural Society, 1863 to 1904, except 1868, 1873, and 1899.
OntFG	Transactions of the Fruit Growers' Association of Ontario, Canada, 1869 to 1905, except 1880 and 1881.
OreH	Biennial Reports of the Oregon State Board of Horticulture, 1891 to 1903, inclusive.
P	Reports of the United States Pomologist, 1887 to 1895, inclusive.

PaFS	Reports of the Pennsylvania Fruit Growers' Society, 1867 to 1876, inclusive.
PF	Prairie Farmer.
PH	Transactions of the Peninsula Horticultural Society, 1888 to 1906, inclusive.
PJB	P. J. Berckmans Co., catalogues, 1901, 1903, 1906.
PNCo	Pioneer Nursery Company, catalogue.
Pr	The Pomological Manual, edition of 1831, by William R. Prince.
Q	Pear Culture for Profit, editions of 1869 and 1883, by P. T. Quinn.
R	Name modified by W. H. Ragan as chairman of a committee of the American Pomological Society.
R&P	Rakestraw & Pyle, catalogue.
S	Fruit Culture, edition of 1885, by William C. Strong.
SBros	Stark Brothers, catalogue, 1901.
SRofA	Special Report of the American Pomological Society, 1904–5.
St	South Haven, Michigan, Experiment Station, list of Mr. T. T. Lyon.
SW	Silas Wharton's catalogue, as republished in Transactions of the Indiana Horticultural Society for 1872, 108.
S&H	Storrs & Harrison, catalogue.
T	The American Fruit Culturist, editions of 1875, 1885, and 1897, by J. J. Thomas.
Th	The American Orchardist, edition of 1822, by James Thacher, M. D.
TVM	T. V. Munson & Son, catalogues, 1889, 1891, 1892, 1893, 1894, 1896, 1899, 1900, 1902, 1903, and 1904.
VaH	Transactions of the Virginia State Horticultural Society, 1898 to 1904, inclusive.
WashH	Biennial Reports of the Washington State Board of Horticulture, 1891–2, 1893–4, 1895–6.
Wg	The Fruit Growers' Hand Book, edition of 1851, by W. G. Waring.
WHR	Western Horticultural Review, monthly, vols. 1 (1850–1), 2 (1851–2), 3 (1852–3), and 4 (1854).
WisH	Transactions of the Wisconsin State Horticultural Society, 1870 to 1905, inclusive.
WisHort	Wisconsin Horticulturist, monthly, March, 1897, to February, 1903, inclusive.
WmP	William Parry, catalogue.
Wn	The California Fruits and How to Grow Them, 1st, 2d, and 3d editions, by Prof. E. J. Wickson.
WNYH	Transactions of Western New York Horticultural Society, 1876 to 1905, except 1877, 1878, 1884, and 1885.
WPr	A Short Treatise on Horticulture, edition of 1828, by William Prince.
WSL&Co	William S. Little & Co., catalogue.
W&TSC	William & T. Smith Co., catalogue.
YB	Yearbook of the United States Department of Agriculture, 1894 to 1905, inclusive.

CATALOGUE-INDEX OF THE KNOWN VARIETIES OF PEARS REFERRED TO IN AMERICAN PUBLICATIONS FROM 1804 TO 1907.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Abbe de Beaumont. D'69,651. A'73,76. Hort'74,148. Syn. of Beaumont									
Abbe Edouard. D'57,448,'69,654. F276. E'59,357. T'75,536,'85,550,'97,692. GaH, '92,49. Syn. of Edouard.									
Abbe le Berriays. Dap155. Syn. of Berriays									
Abbe Mongein. D'57,448,'69,835. F276. E'59,357. Syn. of Pound									
Abbe Perez. D'69,654. Syn. of Perez									
Abbott. Hort'47,241,'66,109. Magof H'48,109,'54,472. Cole159. E'54,348,'59,357. H118. D'57,448,'69,654. AgR'54,245,'56,330. F272. T'75,269,'85,287,'97,466. B'83, 378. A'62,66. Bul6.	R. I.	oblp	m	yrru	bjm	sp	g	me	Originated at Providence, R. I., on farm of Mrs. Abbott.
Abbret. L. Syn. Fondante Abbret	For.								Published by Field, p. 280.
Abercrombie. A'69,51,'73,119. Syn. of Abercromby									
Abercromby. D'69,654. Syns. Abercrombie, Abercromby's Seedling	Ala.	obop	m	gyru	gj	sv	g	me	A chance seedling originated in Tallapoosa County, Ala.
Abercromby's Seedling. D'69,654. Syn. of Abercromby									
Abres. R. Syn. Belle des Abres			vl					vl	Described in Andorra catalogue for 1895 as very large and late.
Achan. MagofH'43,130. Syns. Black Achan, Green Achan									Found growing in Australia by F. M. Webster.
Acme. L. CalSBofH'92,359. A'95,68. Syn. Block's Acme	Cal.	p	l	yrur	cm	jv			Originated by Mr. A. Block, Santa Clara, Cal.
A courte queue. Pr43. GenF'33,196. D'45,378,'57,436,'69,880. HovI185. Syn. of White Doyenne.									
Adams. Cole160. HovI191. MagofH'53,39,'54,464. E'54,388,'59,357. A'54,153,'62, 66. AgR'56,405. D'57,449,'69,654. F272. AHortA'70,77. T'75,258,'85,276,'97,456. B'83,378. KanH'85,316.	Mass.	obop	l	yr	jm	v	vg	me	Originated at Waltham, Mass., and introduced in 1848.
Adelaide. L. Syns. Adelaide de Reves, Madam Adelaide	Belg.	oblp	l	gyru	mj	vs	g	m	
Adelaide de Reves. D'57,449,'69,654. F276. E'59,357. T'75,536,'85,550,'97,693. Syn of Adelaide.									
Adele de St. Cerras. MagofH'49,107,'52,39. E'54,349. H118. D'69,664. T'85,277. Syn. of Mello.									
Adele de St. Denis. MassH'51,189. WHRI'64. E'54,349,'59,357. D'57,453,'69,664. T'97,693. Syn. of Mello.									
Adele Lancelot. MagofH'60,218. D'69,655. Syn. of Lancelot									
Adele St. Dennis. MagofH'52,150. Syn. of Mello									
A deux yeux. F276. Syn. of Jargonelle (Fr.)									
Adlem. R. Syn. Beurre Adlem									Exhibited at Michigan State Fair, 1876. Not described.
Admirable. MagofH'59,207. D'69,655. Syns. Dana's Admirable, Dana's No. 3.	Mass.	rov	ml	yru	jm	v	g	me	Originated by Francis Dana, Boston, Mass.
Admiral. Pr66. Syn. Poir d'Admiral		p		gru		s		me	Described by Duhamel.
Admiral. K'32,191,'41,159. GenF'37,278. A'54,237. Syn. of Cardinale									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Admiral. E'54,388,'59,417. Syn. of Farragut									
Admiral Cecile. EFABC'00. CanExFR'02,380. Syn. of Cecil									
Admiral Farragut. MassH'62,32,'65,44,'82,25. AJofHH225. D'69,655. A'69,46, 100,'77,104,'81,99. AHortA'69,79. GaH'86,50. Syn. of Farragut.									
Admiral Foote. MassH'66,44	Mass.								Originated at Brookline, Mass. Fruited in 1862.
Adolphe Catchet. D'69,655. Syn. of Catchet									
Adolphine. L. Syn. Adolphine Richard	Belg	p	m	ybr	j	vs	g	ml	
Adolphine Richard. MagofH'60,218. D'69,655. Syn. of Adolphine									
Aelens. L. Syn. Rousselet Aelens	Belg	obop	m	yrru	mj	sp			From Annals of Pomology.
Affre. L. Syn. Monseigneur Affre	Belg	r	ms	gru	com	s	g	m	One of Bivort's introductions.
Agathe. L. Syn. Agathe de L'Escour	For								Published by Field, p. 276.
Agathe de L'Escour. F276. Syn. of Agathe									
Aglae Gregoire. MagofH'57,258,'60,19. D'69,655.	Belg	obtp	m	yrb	mj	p	g	vl	From Jardin Van Mons.
A. Gobert. D'69,661. Syn. of Angobert									
Agreeable. L. Syn. Fondante Agreeable		rov	m	gyru	jm	p		me	Described by Col. M. P. Wilder in the Horticulturist, 1854, p. 83.
Ah! Mon Dieu. Cult'39,66. K'41,120. D'45,383,'57,571,'69,656. MassH'46,151. A'54, 237. E'54,394,'59,420. Syn. of Mon Dieu.									
Aimi Ogereau. A'71,56. OH'71,48			m					me	Probably same as Ogereau.
Airoles (Gregoire). L. Syn. Jules d'Airoles (DeX. Gregoire)	Belg	t	ml	yrsb	coj	svp		m	Introduced in 1857.
Airoles (Leclerc). L. Syn. Jules d'Airoles (de Leon Leclerc)	Fr	robtp	m	gyru	jm	svp	vg	ml	Raised at Laval by Leon Leclerc.
Akato. AofH'91,296									Not described.
Akatsupo. AofH'91,296									Not described.
Alamo. JSK'97,'98,'01. PH'97,19. TVM'99,'00. IllH'99,219. EWK'01. HuC'01. Buls. AHM232. PJB'06.	Tex		l	yb	bm			e	Originated by A. L. Bruce, Grayson County, Tex.
Albert. L. Syns. Pear d'Albret, Poire Prince Albert, Prince Albert	Belg	oblp	ml	ybru	j			vl	Originated by Dr. John Van Mons.
Albertine. MagofH'52,298. WHRH559. D'69,742. IEI'99,'01,'02. Syn. of Boussock.									
Alberty. F276									Not described.
Albret. L. T'97,693. Syns. Beurre d'Albret, Beurre Delbret, Calebasse d'Albret, Dalbret, Pear d'Albret, Poire d'Albert, Poire d'Albut.	Eur	p	ml	yru	jbm	vp	vg	m	Introduced in 1846.
Albret (Fon.). L. Syn. Fondante d'Albret	Fr	rob	ml	yrru	cojm	svp	g-vg	me	
Alencon. L. T'97,482. Syns. Doyenne d'Alencon, Doyenne d'Hiver d'Alencon, Doyenne d'Hiver Nouveau, Doyenne Gris d'Hiver, Doyenne Gris d'Hiver Nouveau, Doyenne Marbre, New Gray Winter Vergalieu, New Winter Gray Doyenne, St. Michael d'Hiver.		rovp	m	yru	gbj	p	vg	vl	A foreign variety of unknown origin.
Alexander. D'57,449,'69,656. MagofH'58,135. Hort'58,34. F272. T'75,536,'85,550,'97, 693.	N. Y	obtp	m	yru	gjm	s	vg	m	Originated in the town of Alexander, N. Y.
Alexander Chomier. EFABC'00. Syn. of Chomier									
Alexander de Russie. Cult'39,66. Syn. of Alexander of Russia									
Alexander of Russia. MagofH'50,295. Cult'50,45. A'54,237. Syn. Alexander de Russia.									Rejected by Congress of Fruit Growers, 1849.

Alexander Lucas. GarM'86,366. MoH'86,235. EFABC'00.									Referred to as promising. See Missouri Horticultural Report, 1856, p. 235.
Alexandre Berckmans. F276. D'69,674. Syn. of Berckmans.									
Alexandre Bivort. MagofH'52,298,'57,156. WHRII559. F276. D'69,656. Syn. of Bivort (Alex.).									
Alexandre de Russie. Pr197. K'32,158,'41,134. Syn. of Russia.									
Alexandre Helie. F276. D'69,668. Syn. of Julie.									
Alexandre Lambre. MassH'53,17. WHRII559. CGenHII,xxIII,288. D'57,449,'69,656. AgR'54,245. E'59,258. T'75,536,'85,309,'97,482. EFABC'00. Syn. of Lambre (Alex.).									
Alexandrina. MassH'58,74. F276. MagofH'59,41,502. A'62,66. D'69,656. T'75,'536,'85,551,'97,693. Syns. Alexandrina Bivort, Alexandrine.	Belg.	oblp	ms	yru	jm	s	g-vg	me	Too small to prove of value.
Alexandrina Bivort. D'69,656. Syn. of Alexandrina.									
Alexandrine. AofH'91,296. Syn. of Alexandrina.									
Alexandrine Douillard. MagofH'54,461. E'59,358. MassH'62,32. D'69,656. EFABC'00. Syn. of Douillard.									
Alexandrine Mas. D'69,657. Syn. of Mas (Alex.)									
Alexis. L. Syn. Blanquet Alexis.									Published by Field, p. 278.
Alice Payne. JVL'93,'99,'00. BBL. T'97,693	N. C.		m	y				l	Originated near Salem, N. C. Introduced by J. Van. Lindley.
Alison. FGAofO'74,68.	N. S.								A Nova Scotia seedling.
Alkire. BBL.									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Allerton. MassH'66,44	Mass.								Originated by Dr. S. A. Shurtleff, Brookline, Mass. Fruited in 1862.
Almann. Pr81. D'69,772. Syn. of German Muscat.									
Almond Pear. D'57,466,'69,661. F277. T'75,536,'85,551,'97,693. Syn. of Angleterre.									
A Longue Queue. F276.									Not described.
Alost. L. Syns. Colmar d'Alost, Comtesse d'Alost, Delices d'Alost, Duchesse d'Alost.	Belg.	roblp	l	gyb	mjg	sv	g	m	Introduced from Belgium in 1840.
Alpha. MagofH'38,394,'43,123,'55,269. D'45,348,'57,449,'69,657. Hort'49,456. B'51,312. E'54,348,'59,358. AgR'54,245,'56,405. F276. H118. T'75,258,'85,276,'97,456.	Belg.	obl	ms	gyb	db		g	m	Barry in 1851, p. 312, says, "New; fine."
Alphand. L. Syn. Directeur Alphand.			vl	gyru	m		g	l	In Ellwanger & Barry's catalogue for 1894.
Alphonse Karr. F276. D'69,657. Syn. of Karr.									
Alphonse Karr. T'75,536,'85,551,'97,693. Syn. of Soldat. [Mr. Lyon doubted this].									
Althorp Crassane. K'32,158,'41,134. MagofH'40,46. T'75,536,'85,551,'97,693. Syn. of Althorpe.									
Althorpe. L. Syns. Althorp Crassane, Althorpe Crassane, Althorpe Crassanne, Crassane Althorpe.	Eng.	rov	m	g	bm	p	g	m	
Althorpe Crassane. D'45,352,'57,563,'69,657. WHRI131. E'54,349,'59,359. H118. F276. T'85,551. Syn. of Althorpe.									
Althorpe Crassanne. K'32,158,'41,134. MassH'47,69. Syn. of Althorpe.									
Amadont. Pr106. Syn. of Merveille									
Amadote. F276. Syn. of Amadotte.									
Amadotte. D'57,563,'69,657. E'59,423. T'75,536,'85,551,'97,693. Syns. Amadote, Autumn Superb, Beurre Blanc des Capucins, Dame Houdotte, De Graine Damadote, Madot, Madotte.		p	l	y	gj	v	p	m	Variable; sometimes astringent.
Amalis. T'97,466. Syn. of Amanlis.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Amand. R. Syn. Amand Bivort			m				vg	m	Published in Magazine of Horticulture, 1854, p. 234; also 1855, p. 150.
Amand Bivort. MagofH'54,234,'55,150. Syn. of Amand									
Amanda's Double. D'45,353. E'54,'389,'59,417. Syn. of Amande Double									
Amande. T'97,693	Belg	oblp	m	g	bj		vg	me	
Amande Double. D'45,353. E'54,389,'59,417. H119. Syn. Amanda's Double	Eur	p	m	yr				me	In Elliott's list of rejected varieties.
Amande regenerie. Dap155. Syn. of Walker									
Amande Suede. Pr93. Syn. of Spanish									
Amandine. L. Syn. Amandine de Rouen	Fr	obtp	m	gyru	mj	s	g	m	Received from Andre Leroy, of Angers, France.
Amandine de Rouen. D'69,657. Syn. of Amandine									
Amanlis. L. Bul 6. T'97,693. Syns. Amalis, Beurre Amanlis, Beurre d'Amalis, Beurre d'Amanlis, Beurre d'Amaulis, Hubbard, Kaissoise, Kessoise, Thiessoise, Wilheimmine.	Belg	obo	l	gybr	gbm	p	g-p		
Amanlis Panachee. L. Syn. Beurre d'Amanlis Panachee	Belg	obo	l	gysru	gbm	p	p		Differs slightly from the preceding.
Amber. Pr11. Syn. of Muscat Robert									
Amboise or *Ambroise.* K'32,135. Syn. of Brown									
Amboise or *L'Amboise.* Pr49. Syn. of Brown									
Ambre Gris. K'32,141. E'54,389,'59,417. D'69,658. Syn. of Ambrette									
Ambret. Pr122. D'69,658. Syn. of Ambrette									
Ambrette. C198. Pr122. K'32,141,'41,123. E'54,389,'59,417. H119. F276. D'69,658. HMHS222. Syns. Ambre Gris, Ambret, Ambrette avecepine, Ambrette d'Hiver, Ambrette d'Hiver Avec Epines, Ambrette epineuse, Ambrette Gris, Belle Gabrielle, Cheat Servant, Dechine, Epineuse, Thorny Ambrette, Tilton, Trompe Valet, Winter Ambret.		rov	ms	gyru	gm	s	g	vl	An old variety now but little grown.
Ambrette. Pr122							vg	vl	Ambrette of Prince differs from Ambrette of Coxe.
Ambrette. GarCal587. Pr121. L. Syn. of Echasserie									
Ambrette avec epines. Pr122. D'69,658. Syn. of Ambrette									
Ambrette. (Bour.). L. Syn. Ambrette of Bourgeuil							p	m	Not described.
Ambrette d'Ete. Pr31. Syn. of Grise-Bonne									
Ambrette d'Hiver. Pr122. E'54,389,'59,417. D'69,658. Syn. of Ambrette									
Ambrette d'Hiver Avec Epines. Pr122. Syn. of Ambrette									
Ambrette epineuse. F276. D'69,658. Syn. of Ambrette									
Ambrette Gris. Pr122. D'69,658. Syn. of Ambrette									
Ambrette of Bourgeuil. Pr122. Syn. of Ambrette (Bour.)									
Ambrette (of Coxe). K'32,144,'41,123. Syn. of Echasserie									
Ambrette (Thornless). Pr122. L. Syn. Thornless Ambrette							p	l	Not described.
Ambrosia. Pr193. K'32,126,'41,126,168. GenF'33,196. Cult'39,66. D'45,331,'57,563, '69,658. E'54,388,'59,417. Hort'49,456. H119. F276. T'75,536,'85,551,'97,693. FGAofO'75,58. Syn. Early Beurre.	Fr	robo	m	gyru	b	p	p	me	Poor; now generally discarded.

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Amelie Le Clerc. AHortA'68,78,'69,75. D'69,658. A'69,88. Syn. of Le Clerc (Amelie).									
America. MagofH'59,205,175. D'69,658. MassH'82,38. BBL. EFABC'00. Syns. Dana's No. 19, Dana's Seedling No. 19.	Mass.	roblp	ml	yru	gru	s	g	l	First published as Dana's No. 19, in Magazine of Horticulture, 1859, p. 205.
American Beauty. D'69,740. Syn. of Dorsoris									
American Orange. A'75,101. Syn. Orange	Mass.								Robert Manning showed fruit from this old tree at meeting of American Pomological Society, 1875.
Ames. R. Syn. Ames' Hardy									Fruited by A. Bryant in 1894.
Ames' Hardy. HH'91,137. Syn. of Ames									
Ames' Orgereau. HH'91,137									Fruited by A. Bryant in 1894.
Amie Verdier. MassH'71,40		obo	m	yrb	ny	v	g		Robert Manning said, "Promises to be fine."
Ami Ogereau. HH'96,214. Syn. of Ogereau									
Amiral. MagofH'50,296									Rejected by Congress of Fruit Growers, 1849.
Amiral. B'51,313. D'57,452,'69,662. F276. Syn. of Courbe									
Amiral. E'54,388,'59,417. Syn. of Farragut									
Amiral Cecil. D'69,658. AJofHVIII229. WNYH'05,140. Syn. of Cecil									
Amire Joannet. K'32,131,'41,117. M'38,64,'44,48,'47,56. MassH'47,48. B'51,299. E'54,366,'59,381. Syn. of Harvest.									
Amire Joannet. Pr9. Cult'42,166,'54,249. D'45,330,'57,450,'69,658. E'54,366. AgR'54,293,'56,344. T'75,536,'85,551,'97,693. Syn. of Joannet.									
Amire Johannet. D'69,658. Syn. of Joannet									
Amire roux. Pr124. K'32,132. D'69,862. Syn. of Archduke									
Amire roux de Tours. D'69,862. Syn. of Archduke									
Amory. K'32,158,'41,134. D'45,349,'57,451,'69,660. MassH'47,52. Hov I,97. B'51,302. T'75,536,'85,551,'97,693. Syn. of Andrews.									
Amoselle. Pr73. D'45,430,'57,564,'69,784. E'54,389,'59,417. F277. Syn. of Hollande.									
Amour. Pr117. K'32,149. D'69,659. Syns. D'Amour, Love Pear, Poire d'Amour, Poire Tresor d'Amour, Treasure, Tresor, Tresor d'Amour.		oblp	vl	gyb	g	a		vl	A coarse pear, only fit for cooking.
Ananas. MagofH'47,341. Hort'48,242. H119. A'75,68. Bul6,8. AHM232. Syns. Ananas de Courtrai, Ananas d'Ete, Ananas Francaise, Annanas, Beurre Ananas, Bouchert, Comprette, De Bouchet, Favori Musque, Favori Musque du Conseiller, Henry IV (incorrectly), Pouchet, Summer Pine Apple.									Possibly same as Ananas d'Ete.
Ananas. F294. E'59,390. AgR'54,245. A'62,68. MoH'62,104. D'69,782. T'75,536, '85,551,'97,693. Syn. of Henry IV.									
Ananas. Pr136. Syn. of Passe Colmar									
Ananas de Courtrai. E'59,358. PaFS'71,66. A'75,68. Dap155. Syn. of Ananas.									
Ananas de Courtrai. D'57,450,'69,659. Syn. of Courtrai									
Ananas de Courtral. T'75,536,'85,551,'97,693. Syn. of Ananas d'Ete									
Ananas de Courtray. D'69,659. Syn. of Courtrai									
Ananas d'Ete. D'45,350,'57,450,'69,660. E'51,339,'59,323. H193. F227. A'62,66. Hort'71,369. WisHort'73,88. B'83,365. HH'85,68. T'75,258,'85,276,'97,456. Syns. Ananas de Courtrai, Ananas de Courtral, Ananas Francais, Ananas (of Manning and of Leroy), Beurre Ananas, Comprette, D'Ananas d'Ete, De Bouchet, Du Bouchet, Favori Musque, Favori Musque du Conseiller, Henry IV (incorrectly), Poire Ananas, Pouchet, Summer Pine-apple.	Hol.	obtp	l	ybru	bm	spv	vg	me	An old but valuable late summer pear.
Ananas d'Ete. Dap155. A'75,68. Bul6,8. AHM232. Syn. of Ananas									
Ananas d'Hiver. D'57,532,'69,829. Syn. of Passe Colmar									
Ananas Francaise. Dap155. A'75,68. Syn. of Ananas									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Ananas Francais. D'69,660. Syn. of Ananas d'Ete.									
Ananas (of Manning and Leroy). MassH'44,59. D'45,350,'57,450,'69,660. E'54,339, '59,323. Syn. of Ananas d'Ete.									
Anastere. L. Syns. Blanquet Anastere, Blanquet Anasterque, Blanquet d'Austrasia.	Fr.	p	s	gyb	co		p	me	Of no special value.
Anderson. D'69,835. Syn. of Pound.									
Anderson's Favorite. SW. IndF'40,136. WHR164,1177. D'69,751. Syn. of Easter Bergamot.									
Andre Desports. D'69,660. MassH'73,96. B'83,362. T'85,551,'97,693. E&B'90. EFABC'00. AHM241.	Fr.	obtp	m	gyb	jgm	s		e	Originated in 1854 by Andre Leroy, of Angers, France.
Andrews. MagofH'37,14,'44,294,'47,439. M'38,74,'44,51,'47,61. D'45,349,'57,451,'69,660. MassH'47,51. K'32,158,'41,134. Cole161. B'51,302,'83,374. Wg66. Hov197. AgR '54,293. E'54,248,'59,358. H119. F226. A'62,66. T'75,258,'85,276,'97,456. Hort '69,261. Q60. Syns. Amory, Beurre Oudinot, Gibson, Oudinot.	Mass.	p	l	gyr	jm	v	vg	me	A valuable American variety.
Andrews (Kings.). L. Syns. Andrews' Kingsessing, Judge Andrews	Pa	oblp	m	yr	cod		p	me	Not valuable.
Andrews' Kingsessing. D'69,794. Syn. of Andrews (King.)									
Andusson. L. Syns. Beurre Andusson, Lucie Andusson, Lucie Audusson	Fr.	robtp	ml	yru	djm	sp		m	Raised by Alexis Andusson, of Angers, France.
Ange. MagofH'43,123. Syn. of Angel.									
Angel. L. T'97,693. IllH'97,213. BBL. Syns. Ange, Angel Pear, Poire d'Ange.	Eur.			yg	co	sa		me	An old and probably obsolete variety.
Angelic pear. Pr79. Syn. of Angelique.									
Angelique. R. Syns. Angelic pear, Angelique de Bordeaux, Angelique de Rome, Crestaline, Gros Franc Real d'Hiver, Gros Franc Real or Franc Real Gros, Molle Bouche d'Hiver, Poire Angelique, Poire Douce, Saint Marcel, St. Martial, Saint Martial.	Fr.	obtp	m	gybr	bjm			vl.	Described by Hogg.
Angelique de Bordeaux. Pr79. K'32,142,'41,124. F276. D'69,660. Syn. of Angelique.									
Angelique de Rome. Pr80. K'32,142,'41,124		obl	m	y	m	s		vl	Probably distinct from Angelique.
Angelique de Rome. Pr79. MassH'47,69. Syn. of Angelique.									
Angelique de Rome. F276. Syn. of Angelique (Rome).									
Angelique Le Clerc. D'69,661. Syn. of Leclerc (Angelique).									
Angelique (Rome). L. Syn. Angelique de Rome.	For.								Published by Field in undescribed list.
Angel Pear. Pr25. AJC'95. Syn. of Angel.									
Angers. MassH'47,69. MagofH'50,295. A'54,237									Exhibited by Robert Manning in 1847.
Angleterre. C192. Pr55. K'32,134,'41,121. D'45,351,'57,563,'69,661. E'54,388,'59,417. H120. F276. T'75,536,'85,551,'97,693. EFABC'00. Syns. Almond Pear, Angleterre or English Beurre, Archiduc Charles, Bec d'Oie, Beurre Amande, Beurre d'Angleterre, Beurre Judes, Dobbel Amandel (of the Dutch), English Beurre, Long de Monkouty, Longue de Markouts, Longue de Monkowty, Longue de Nakourts, Monkowthy, Noisette, Poire d'Angleterre.	Fr.	oblp	l	gru	bjm		g	me	An old French variety.

Angleterre d'Hiver. Pr120. F256. D'69,661. EFABC'00. Syn. of Angleterre (Winter).									
Angleterre Nain. D'69,661. Syn. of Nain.									
Angleterre (Nois.). L. Syns. Angleterre de Noisette, Angleterre Noisette, Grosse Angleterre, Grosse Angleterre de Noisette.	Fr	r	l	g			g	l	Originated by M. Noisette.
Angleterre de Noisette. Pr150. Syn. of Angleterre (Nois.)									
Angleterre Noisette. E'54,389,'59,417. Syn. of Angleterre (Nois.)									
Angleterre or English Beurre. Pr55. Syn. of Angleterre									
Angleterre Parfume. D'69,661. Syn. of Nain									
Angleterre (Win.). L. Syns. Angleterre d'Hiver, Angoisse blanche		aep	l	gybr	j	a		vl	An old late-keeping cooking pear.
Angober. DomEncIV'88. Syn. of Angobert									
Angobert. D'69,661. Syns. A. Gobert, Angober, Beurre de Semur, Dagobert, De Sainte Catherine, Double Mansuette, Gros Angobert, Mansuette, Mansuette Solitaire, Solitaire, Solitary Mansuette.		obtp	bvl	gy	mj	a		me	A very old variety; described in 1660.
Angoisse blanche. D'69,661. Syn. of Angleterre (Win.)									
Angoisse Var. L. Syn. Bon Chretien d'Angoisse Variegated	For.								In Field's undescribed list.
Angora. MagofH'42,169. D'45,423,'69,835. Cult'47,340. B'51,311. H120. A'62,70. F276. T'97,693. Syn. of Pound.									
Angouleme. K'32,171. AgR'50,95. MichH'86,420. HAJ'89,37. MichSB27. T'97,456. Bul6,8. AHM232. Syns. Beurre Soule, Des Esparronais, Duchess, Duchesse d'Angouleme, Duchesse of Angouleme, Poire des Eparaznais, Rezenas.	Fr	oblobo	vl	gyru	bj	sa	vg	m	Exhibited by S. G. Perkins at Boston in 1830.
Angouleme Panache. HAJ'88,74									Perhaps distinct.
Angouleme (Var.) L. Syn. Duchesse d'Angouleme Variegated	For.								In Field's undescribed list; possibly distinct.
Anjou. Hort'72,18. MichH'73,407. WNYH'80,146. S91. CanH'88,56,'92,33. HAJ'90,62. AofH'91,296. IllH'84,299,'90,108,123. IndH'91,127. T'97,466. Bul6,8. H-B'03,136. NebH'05,205. Syns. Beurre d'Anjou. Beurre Niell, Butter of Anjou, Colmar Bosc d'Anjou, Fondante du Bois, Nec Plus Meuris, Ne Plus Meuris (of the French), Poire Niell.	Fr	obtp	l	gyru	dmj	vp	vg-b	m	Imported in 1842; exhibited by Col. M. P. Wilder in 1844.
Anna Audisson. MassH'62,32. D'69,661. EFABC'00. Syn. of Audisson									
Ananas. Wg66. Syn. of Ananas									
Anna Nells. NYC'90. E&B'94. JHS&S. EFABC'00									Introduced as new by Ellwanger & Barry in 1894.
Anna Ogereau. C O H S'91,20. P'95,38. IllH'96,35,178,'98,173,336,'99,203,'04,223. AHM257. Syn. of Ogereau.									
Anne de Bretagne. EFABC'00									Being tested at Agassiz, B. C., experiment station.
Anneniere. L. Syn. Beurre Anneniere	For.								Published by Field, p. 277.
Anne Ogereau. AofH'90,173. Syn. of Ogereau									
Annie Joannet. IllH'67,183								ve	Reported from Logan County, Ill., as very early.
Anne Ogereau. WnI,333,II,342. IllH'99,99. Syn. of Ogereau									
Anniversary. L. Syn. Twenty-Fifth Anniversaire de Leopold I	Belg.	obop	ml	gyru	bmj	sp		m	Raised by M. Gregoire, of Jodoigne, Belgium.
Ansault. E&B'90. OH'95,8. CanH'01,454. Bul6,8. EFABC'00. AHM233. FESofO'04,42. Syns. Bonne de Puits-Ansault, Bonne du Puits Ansault.	Fr	robtp	ms	gyru	djm	sv	vg	me	Catalogued by Ellwanger & Barry in 1890.
Anthony Thatcher. A'75,102. IndH'75,42. Syn. of Thatcher									
Antoine. L. Syns. Beurre Antoine, St. Germain Fondant		oblp	ml	gy	bjm	s	g	me	Originated in 1822; christened in 1849.
Antoine Delfosse. EFABC'00									On trial at Agassiz, B. C., experiment station.
Antoine Lorimer. FGAofO'83,72	Eur.								On trial in Ontario, Canada.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Antoinette. AgR'58,397. L. Syn. Beurre Antoinette	Belg.	rp	m	gyru	jb	spv	g	me	Originated in 1846.
Anvers. R. Syn. Charlotte d'Anvers									Published in Magazine of Horticulture, 1855, p. 146.
Apothecaries Pear. DomEncIV,190. Syn. of Bon Chretien (Sum.)									
Apothecary. PaFS'71,66			l					e	Possibly Bon Chretien (Sum.).
Apothecary Winter. EFABC'00									In the collection at Agassiz, B. C.
Appert. L. Syn. Therese Appert	Fr	robop	m	yrbru	jm	sv	vg	me	Raised by Andre Leroy, of Angers.
Apple. L. Syns. Apple Pear, Beurre de Rackenheim, Poire Pomme, Pomoire		rob	s	ygru	dmj		g	m	
Apple Pear. Pr99. A'54,237,'75,101. D'69,662. Syn. of Apple									
Apple Shaped. IndF'40,105	Ind								Originated in Henry County, Ind. Exhibited by J. Osborn in 1840.
Apres Noel. F276. Syn. of Noel									
Arbre Courbe. K'41,170. Mag of H'42,250,'48,112,'53,542. B'51,313. D'57,452,'69,662. CGenIII,11. F276. T'75,536,'85,551,'97,693. Syn. of Courbe.									
Arbre Superbe. D'69,762. Syn. of Lucrative									
Archangel. L. Bul6,8. AHM233. Syns. Dusnas, Jergils, Plombgastel, Plougastel, Plumbgastel, Roger's Elizabeth, St. Michel Archange, St. Michael Archangel, Saint Michael Archangel.	Fr	obop	l	yru	bjm	p	g-vg	m	Imported in 1840.
Arch Duc Charles. B'51,312. Syn. of Hardenpont (Belg.)									
Archduc d' Ete (erroneously). Pr9. E'54,366,'59, 381. Syn. of Harvest									
Archduc d' Ete (erroneously). D'45,330,'57,450. Syn. of Joannet									
Archduke. R. Syns. Amire Roux, Amire Roux de Tours, Archduke of Summer, Archiduc d'Ete, Brown Admired, De-la-Mi-Jullet, Great Onion Pear, Gros Ognonet, King of Summer (erroneously), Ognonet, Ognonet Musque, Ognonnet, Oignonet, Poire d'Oignon, Roi d'Ete (erroneously), Summer Archduke.		obop	m	ygbr	gj	s		e	Described by Hogg as Summer Archduke.
Archduke Charles. D'69,733. Syn. of Hardenpont (Belg.)									
Archduke of Austria. MagofH'37,50. MassH'37,38	Eur					d	p	me	Fruited at Boston in 1837.
Archduke of Summer. Pr24. D'69,862. Syn. of Archduke									
Archiduc Charles. F278. Syn. of Angleterre									
Archiduc d' Ete. Pr24. K'32,132. D'69,862. Syn. of Archduke									
Archiduc Jean. R. Syn. Archiduc Jean d'Autriche	Fl						vg		Published in Magazine of Horticulture, 1855, p. 146.
Archiduc Jean d'Autriche. K'32,159. MagofH'55,146. Syn. of Archiduc Jean									
Aremberg. AgR'50,95. S92. T'59,478. L. Syns. Beurre Burchardt, Beurre d'Aremberg, Beurre d'Aremburgh, Beurre d'Arembert, Beurre d'Hardenpont (erroneously), Beurre Deschamps, Beurre d'Orphelines, Beurre des Orphelines, Beurre Orphelines of Deschamps, Colmar Deschamps, D'Aremberg Parfait, Delices des Orphelines, Deschamps, Duc d'Aremberg, L'Orpheline, L'Orpholine, Orpheline d'Enghien, Poire d'Aremberg, Soldat Laboreur (of some).	Fr	obo	m	gyru	bmj	v	vg	l	Only rarely succeeds well.
Aremberg. (Aut.). L. Syn. Fall Beurre d'Aremberg	Mass	robtp	m	gyru	cojm	svp	vg	m	Raised by Asahel Foote, of Williamstown, Mass.
Aremberg Colmar. L. Syns. Cartofel, Colmar d'Aremberg, Kartofel	Belg.	robtp	l-vl	gyru	dg	sv	g	l	Mainly desirable for its size and cooking qualities.

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Aremberg (Duchesse). L. Syn. Duchesse d'Aremberg	Fr	obtp	m	g	codj		g	me	
Aremburg (Sum.). L. Syns. Summer Aremberg, Summer Beurre d'Aremburg	Eng	ovt	ms	yru	dmj	vp		me	Raised by Thomas Rivers, of England.
Argentine. R. Syn. Inconnue Argentine									Published in Magazine of Horticulture, 1843, p. 131.
Arkansas. R. Syn. Arkansas Mammoth									This may prove to be Pound. See Missouri Horticultural Report, 1896, p. 37.
Arkansas Mammoth. MoH'87,96,'96,37. NYC'90. C(O)HS'92,32. Syn. of Arkansas.									
Arlequin. L. Syn. Arlequin Musque		obop	l	ygb	bm	s	g	me	An old variety; perhaps of little value.
Arlequin Musque. F276. D'69,662. Syn. of Arlequin									
Arlon. R. Syn. Beurre d'Arlon									On trial at Agassiz, B. C., experiment station.
Armand Morel. AndN'95. Syn. Armand Morelle							g	l	Said to resemble Glout Morceau.
Armand Morelle. EFABC'00. Syn. of Armand Morel									
Armenian. Pr107. K'32,150,'41,128. Syn. of Double Flower									
Armenie. Pr107. K'32,150. Syn. of Double Flower									
Armudi. A'54,237									In rejected list of Congress of Fruit Growers, 1849.
Arnaud. L. Syn. Beurre de Saint Arnaud	Belg	robo	ms	ybr	dbj		g	m	Originated in 1853.
Arnaud Bivort. F276	For								In Field's undescribed list.
Arnold. IndH'91,153,'92,103,'94,144. OH'92,71,'01,29. C(O)HS'92,130. MassH'93,249. IllH'96,186,214,'98,142,'99,203. BBL. IaH'99,86. Syn. Furnas.	Ind	oblp	m	yru	bjm	sv	g	vl	Originated at Danville, Ind. First exhibited in 1891.
Aromatic Winter. EFABC'00									On trial at Agassiz, B. C., experiment station.
Arteloire. D'69,850. Syn. of Saint Germain									
Arthur Bivort. D'69,662. Syn. of Bivort (Art.)									
Artois. L. Syns. Beau Present d'Artois, Present Royal de Nantes, Present Royal de Naples.	For	oblp	l	gyru	bjm		g-vg	me	Highly esteemed by some.
Artoisenet. L. Syn. Colmar Artoisenet	Belg	obtp	l	ybru	cojm	v	g	m	
Ascension. EFABC'00									In experimental orchard at Agassiz, B. C.
Ashton Town. Pr129. GenF'37,277. D'45,351. Syn. of Aston									
Aspasia d'Ancourt. EFABC'00									In experimental orchard at Agassiz, B. C.
Assomption. L. T'97,693. Syns. Beurre Assomption, Beurre d'Assomption, Beurre del Assomption, Beurre de l'Assomption.	For	oblp	l	yr	dmjg	sa		e	Origin near Nantes. Described by Leroy.
Aston. L. Syns. Ashton Town, Aston Town		rt	s	yb	db	sp	g-p	me	
Aston Town. K'32,159,'41,168. GenF'33,196. Cult'39,66. WHRI,130. A'54,237. E'54,389,'59,117. D'57,563,'69,662. T'75,536,'85,551'97,693. KanH'82,136. IaH'84,509. EFABC'00. Syn. of Aston.									
A Teline. D'69,884. Syn. of Bon Chretien (Win.)									
Aubitch. R. Syn. Beurre d'Aubitch									In experimental orchard at Agassiz, B. C.
Auch. L. Syns. Bon Chretien d'Auch, Bon Chretien Panache, D'Auch		p	l	gyru	jm	s		l	
Audibert. D'69,662. Syn. Belle Audibert		obtp	l	y	cog	sa	g	m	
Audibert. D'69,688. Syn. of Duval									
Audisson. L. Syns. Anna Audisson, Beurre Anna Audisson, Doyenne Anna Audisson.	Fr	robtp	m	ygru	jm	s	g-vg	m	Originated at Angers, France.
Audusson. T'97,693. Syn. of Ridelle									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Auger. F276. D'69,667. Syn. of Beauvalot.									
Augert. D'69,667. Syn. of Beauvalot.									
Augere. MassH'40,151. D'69,667. Syn. of Beauvalot.									
Auguste Benoist. A'62,66. Syn. of Benoist.									
Auguste Boyer. F276. Syn. of Royer.									
Auguste de Boulogne. F276. Syn. of Boulogne.									
Auguste de [illegible]. Hort'58,75. F'59,59. D'69,684. T'75,537,'85,551,'97,693. Syn. of Koning.									
Auguste [illegible]. D'69,562. Syn. of June.									
Auguste Lelieur. D'69,663. Syn. of Lelieur.									
Auguste Miguard. GenM'[illegible]. HAHS'74. WNYHS'93,44,'96,25. Syn. of Miguard.									
Auguste Royer. MagofH'57,258. D'57,453,'69,663. AHortA'71,66. T'75,269,'85,287,'97,466. EFABC'00. Syn. of Royer.									
[illegible]. Syn. of Soldat.									
Augustin. L. Syns. Poire de Pise, Saint Augustin, St. Augustin, St. Austin.	For.	ovlp	m	gyb		p		l	An old variety; probably of little value.
Augustin Baly. [illegible]									Not described.
Augustine Lelieur. F276. D'69,663. Syn. of Lelieur.									
August Muscat. K'32,136,'41,118. GenF'37,277. Syn. of Aurate.									
August. Hort'67,242. Syn. of Richardson.									
August Perfume. Pr23. K'41,119. D'69,828. Syn. of Perfume.									
August Rousselet. L. Syn. Gros Rousselet d'Aout.	Belg.	p	m	gyru	dmj	svp		me	Raised by Dr. John Van Mons. Catalogued in 1823.
Augustus. L. Syns. Augustus Dana, Dana's No. 10.	Mass.	obtp	m	yru	jm	sp	g-vg	m	Originated by Francis Dana, of Boston, Mass.
Augustus Dana. MagofH'60,267,500. MassH'65,45,'66,46,'82,38. A'67,157. D'69,663. CGenXXIII,190. T'75,269,'85,287,'97,466. WnI,333,II,342. CanFExR'95,392. EFABC'00. Syn. of Augustus.									
Aumale. L. Syns. Duc d'Aumale, Gedeon Paridant, Gideon Paridante.	Belg.	obtp	m	ybm	j	sa	g-vg	me	Originated by Dr. John Van Mons.
Auneniere. L. Syn. Beurre Auneniere.	Fr.?	roblp	m	gy	jm	sa	g	m	Supposed to have originated in France.
Aunt Desire. HMH84.	Mass.								An early seedling in Massachusetts Colony.
Aurate. CI81. Pr12. K'32,136,'41,118. GenF'37,277. H120. F276. D'69,663. Syns. August Muscat, Auratta, Muscat d'Aout, Muscat de Nancy, Musk or Spice, Poire dorée.		p	s	yg	j	v	vg	ve	An old variety now unknown.
Auratta. SW. Syn. of Aurate.									
Auray. L. Syn. Supreme d'Auray.	For.								In Field's undescribed list.
Aurore. F278. D'69,682. Syn. of Capiaumont.									
Autumn Bergamot. IaH'84,509. IaB3. FGAofO'91,11. AHM234. Syns. Autumn Bergamot (of the Volga), Bergamot Osennui, Bergamotte Osenii (of Regel).	Rus.?	r	l					m	A Russian variety of doubtful value.

Autumn Bergamot. GarCal587. WPr9. K'32,133. GenF'33,196,'37,277. Cult'39,66. D'45,366,'57,565,'69,663. E'54,389,'59,417. A'54,237. AgR'54,251. MichH'73,343. Syn. of Bergamot (Aut.).									
Autumn Bergamot. K'41,121. HH'68,311. KanH'82,136. Syn. of Bergamotte d'Automne.									
Autumn Bergamot (of the Volga). MHSC'82,55. FGAofO'83,220. Syn. of Autumn Bergamot.									
Autumn Bon Chretien. Pr147. Syn. of Harrison									
Autumn Bon Chretien. Pr.93. D'69,858. Syn. of Spanish									
Autumn Bounty. K'32,135,'41,126. MagofH'37,15. Syn. of Bounty									
Autumn Burgamot. SW. Syn. of Bergamot (Aut.)									
Autumn Catherine. Pr20. D'69,846. Syn. of Rheims									
Autumn Colmar. Pr197. K'32,159,'41,141. GenF'33,196,'37,277. Cult'39,66,'48,369. D'45,353,'57,453,'69,663. E'54,389,'59,417. H120. F276. T'75,537,'85 551,'97,694. Syn. Colmar d'Automne.	Fr	obtp	m	gru	gb	v	g	m	Published by Lindley.
Autumn Colmar. D'57,570,'69,724. Syn. of Summer Colmar									
Autumn Hardenpont. L. Syns. Beurre d'Hardenpont, d'Automne, Wilfred		oblp	ml	yru	j	sp	g-vg	m	
Autumn Melting Wg66. D'69,762. Syn. of Lucrative									
Autumn Mouthwater. Pr56. Syn. of Long Green									
Autumn Mouthwater. D'69,804. T'85,282. Syn. of Long Green (Aut.)									
Autumn Nelis. D'69 664. AHortA'70,68 Syns. Graham's Autumn Nelis, Graham's Bergamot.	Eng	obop	m	gyru	bgm	p	vg	m	Tree much like Winter Nelis.
Autumn Paradise. AgR'50,94,'67,139. E'54,349. H120. T'75,258,'85,276,'97,457. Syn. of Paradise.									
Autumn Polish Bergamotte. CanH'90,238. Syn. of Sapieganka									
Autumn Superb. MagofH'37,15. M'38,75,'44,60. K'41,168. A'54,237. H121. D'69,657. Syn. of Amadotte.									
Aux Truites. F280. Syn. of Forelle									
Auzolle. L. Syn. Ernestine Auzolle	Fr	rp	s	gybru	cojm	s		m	
Avalon. R. Syn. Beurre d'Avalon									In experimental orchard at Agassiz, B. C.
Avanche. Pr97. K'32,146. Syn. of Louise Bonne									
Averat, Pear Royal, Muscat Pear of August. Pr33. K'32,131. Syn. of Robine									
Avocat. R. Syn. Avocat Nelis									Published in Magazine of Horticulture, 1857, p. 258.
Avocat Allard. AJofHIX,30	Belg		s				vg		One of Gregoire's numerous seedlings.
Avocat Nelis. MagofH'57,258. MassH'62,32. Syn. of Avocat									
Avocat Tonnelier. EFABC'00									In experimental orchard at Agassiz, B. C.
Avoine. L. Syn. Beurre d'Avoine	Belg?	ob	m	gyru	jm	s	g-vg	m	
Avorat. Pr33. Syn. of Robine									
Avorat, Robine. Muscat d'Avust, August Muscat. Pr33. Syn. of Robine									
Avril. D'69,664 Syns. D'Avril, Poire d'Avril		robtp	l	gyru	gjm	s	g	l	
Ayer. P'95,37. A'97,44. AHM234	Kan	obop	m	yru	tj	sa	vg	me	Originated by O. H. Ayer, Lawrence, Kans.
Baba. Gb, CanExFG'96,135. FESofO'98,120. FGAofO'00,18. EFABC'00. Syn. Grusha Baba.	Rus								Considerably disseminated in the Canadian provinces.
Bachelier. D'69,673. Syns. Bachelor, Beurre Bachelier, Chevalier	Fr	obtp	ml	gyru	bjm	vp	vg	l	Introduced in 1845.
Bachelor. Cult'49,181. Syn. of Bachelier									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bachmann. R. Syn. Dr. Bachmann	S. C.	r	m	gr	j	v			In Transactions American Pomological Society, 1867, p. 190, as "Dr. Bachmann."
Backholda. CanH'94,291	Can.	obl	l	y		sa		m	A new Canadian variety.
Badham's. GenF'33,196. D'45,357,'57,471,'69,710. E'54,350,'59,360. Syn. of Brown									
Bagpipe of Anjou. Pr15. D'69,775. Syn. of Blanquette									
Bagpipe of Autumn. Pr113. Syn. of Pastorale									
Baguet. R. Syn. Beurre Baguet	Fr.	p	m	gru	mj	a		m	Received from Alexander Bivort.
Bailey. L. Syn. Beurre Bailey	Fr.	p	l	ygb	djmg	s		m	First fruited in 1848. Described by Leroy.
Bakholda. CanH'94,291									Doubtless same as Backholda.
Baking. L. Syn. Winter Baking	Mass.							l	An old baking variety. Published by Thacher, p. 193.
Baking. MagofH'49,43	Conn.								Raised by Gov. Edwards, New Haven, Conn.
Bal Armadi. MagofH'42,376									Not described.
Balderston. R. Syn. Balderston's									Catalogued by Silas Wharton in 1824.
Balderston's. SW. Syn. of Balderston									
Ballarde. R. Syn. Jallai Ballarde									Published in Magazine of Horticulture, 1843, p. 131, as "Jallai Ballarde."
Ballet. R. Syn. Beurre Ballet									Mentioned by J. H. Haynes, of Indiana, in Horticulturist, 1873, p. 37.
Baltet Pere. R. Syn. Beurre Baltet Pere									Possibly same as Baltet.
B. Amanlis. IllH'93,89. Syn. of Amanlis									
Bancreif. D'69,729. Syn. of Crawford									
Bancroft. R. Syn. Bancroft's Hamburg									Published in Magazine of Horticulture, 1837, p. 51.
Bancroft's Hamburg. MagofH'37,51. Syn. of Bancroft									
Band de la Cour. D'69,811. Syn. of Marechal (Cour.)									
Bankerbine. E'54,349,'59,359. T'75,537,'85,551,'97,694		obo	m	gy	cob			m	Grown by Ellwanger & Barry.
Banks. MassH'66,45	Mass.								Originated in Brookline, Mass. Fruited in 1863.
Banneau. D'69,701. Syn. of Veterans									
Baptiste. L. Syn. Jean Baptiste Bivort	Belg.	obtp	l	yr	mbj	sp		ml	Published in Annals of Pomology.
Barbancinet. F276. MagofH'60,126. D'69,664. A'75,46. FGAofO'75,59	Fr.	oblp	m	gybu	jm	v	vg	me	Originated by Andre Leroy, Angers, France.
Barbe Nelis. MagofH'65,150,'57,258. D'69,664	Belg.	obtp	s	gyru	bjm	s	g	e	Raised by Gregoire, of Belgium.
Barillet. EFABC'00									In the collection at Agassiz, B. C.
Barker. H121		obo	m	gy	co		g	m	

Barland. C212. Pr209. GenF'33,197,'37,278. MagofH'37,60. CGenX,239	Eng	ov	s	gru					Known in 1674. Raised for perry only.
Barnadiston. MagofH'51,472									Not described.
Barnard. HovI,51. Syn. of Flemish									
Barnett's William. D'69,666. Syn. of Bartlett									
Barny. L. Syns. Loriol de Barney, Loriol de Barny	Fr	obtp	ml	yru	jm	s	g-vg	me	Originated by Andre Leroy, Angers, France.
Baron. EFABC'00									In the collection at Agassiz, B. C.
Baron de Caters. EFABC'00									In the collection at Agassiz, B. C.
Baron de Geer. A'75,68. Dap155. Syn. of Henri Van Mons									
Baron Deman de Lennick. MagofH'60,218. D'69,664. Syn. of Deman									
Baron de Mello. AgR'56,367. WnI 333 II, 342. IllH'96,186. Syn. of Mello									
Baronne de Mello. MassH'51,189. WHR,II,559. E'54,355,'59,357. T'75,258,'85,277,'97,457. A'75,68. D'69,664. B'83,366. EFABC'00. Syn. of Mello.									
Baronne Leroy. Hort'73,37. EFABC'00									In the trial orchard at Agassiz, B. C.
Baronsbirne. CanExFR'03,422		oblp	l	gz				l	In the trial orchard at Agassiz, B. C.
Baron Treyve. MassH'73,96				g			g		Exhibited at meeting of Massachusetts Horticultural Society, August, 1873.
Barronne de Mello. D'57,453. Syn. of Mello									
Barry. MagofH'54,235. D'57,453,'69,665. E'59,259. T'75,259,'85,277,'97,457. MichSB27. MoH'92,233,236. IllH'96,178. Syns. De Leslumieres, De Lestumire, Doyenne Barry.	Eur								An old variety reintroduced and renamed.
Barry. A'75,38. MassH'76,95. CanH'93,58. MichB194. AHM234. Syn. of P. Barry.									
Barseck. R. Syns. Bar-Seck, Bar-Seckel, Bartlett-Seckel, Bartseckle, Columbia	N. Y.	oblp	l	gy	jm	v	vg		Raised by Jacob Moore, Rochester, N.Y., from Seckel×Bartlett.
Bar-Seck. WNYH'90,175. Syn. of Barseck									
Bar-Seckel. WNYH'91,134. E&B'94,20. Syn. of Barseck									
Bartseckle. NYC'90. Syn. of Barseck									
Bartlett. Pr137,214. K'41,155. WPr12. D'45,334,'57,421,'69,666. Cole156. HovII,11. B'51,299,'83,362. G'83. E'54,311,'59,324. H121. F190. Hort'53,350,'70,360,'71,183. Fi52. T'75,250,'85,268,'97,451. Bl228. WnI,325,II,335,III,258. MeR'89,138. Syns. Barnett's William, Bartlett (of all American Gardens), Bartlett or Williams Bon Chretien, Bon Chretien Barnett, Clement Doyenne, Delavault, Delavault de Clement, Poire Guilliam, Poire Guillaumé (of the French), Summer St. Michael, Williams, Williams Bon Chretien.	Eng	oblp	l	yreu	bjm	sp	vg	me	The most universally popular pear. In California it is indorsed as four times more valuable than any other variety.
Bartlett (of all American gardens). D'45,334,'57,421. Syn. of Bartlett									
Bartlett or Williams Bon Chretien. D'45,334,'57,421,'69,666. HovII,11. H121. F190. T'75,250,'85,268. Syn. of Bartlett.									
Bartlett-Seckel. C(o)HS'92,32. IllH'96,45,180. MichB177,194. SBro. FDNCo'01. FESofO'02,71. Syn. of Barseck.									
Bartlett Seedling. MagofH'40,173	Mass.								Grown by Robert Manning; perhaps valueless.
Bartram. MagofH'39,395. Hort'60,258. A'60,121,'69,44,'99,15. D'69,667. T'75,537,'85,551,'97,694.	Pa	obtp	m	ybm	gjm	v	vg	me	Originated on farm of Miss Anna Bartram, near Philadelphia, Pa. Published in Western Horticultural Review, vol. 4, p. 165.
Basce. R. Syn. Beurre Basce									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Basiner. L. Syn. Charles Basiner	Eur	obo		yg	j	s		m	Described by Hogg.
Bassin. Pr37. D'69,767. Syn. of Jargonelle (Fr.)									
Bastie. R. Syn. President de la Bastie									In experimental orchard at Agassiz, B. C.
Bauchan. R. Syn. Calebasse Bauchan									Published in Magazine of Horticulture, 1855, p. 146.
Baud de la Cour. D'69,811. Syn. of Marechal									
Baudry. St. AHM234. FESofO'04,43. Syns. Bon Chretien Fred Baudry, Fred Baudry.									On trial at Agricultural College, Michigan.
Bauvier. L. Syn. Bauvier d'Automn.	Rus.								Introduced from Russia in 1882.
Bauvier d'Automn. Gb. Syn. of Bauvier									
Bavay. L. Syns. De Bavay, Poire de Bavay	Belg	obtp	m	yru	cojm	sp	g-vg	m	Published in Magazine of Horticulture, 1853, p. 542.
Baylor. WNYH'05,140									Exhibited by Ellwanger & Barry in 1905.
Bayonnaise. D'69,861. Syn. of Green Sweet									
Beacon. NYC'90. E&B'94. EFABC'00. CanExFR'02,379		obtp	ms	y	jg	s	g	me	Cultivated at experimental farm, Agassiz, B. C.
Beadnell. E'54,357,'59,367. H122. D'69,667. T'75,537,'85,551,'97,694. Syn. Beadnell's Seedling.	Eur	p	m	ygr	mj		g	me	Described by Elliott.
Beadnell's Seedling. E'54,357,'59,367. Syn. of Beadnell									
Beamish. F.GAofO'82,82	Ont						g		Originated near Kingston, Ontario.
Bear. Gb. Syns. Dula Medviedevka, Medviedevka, Medviedka, Midvedevka	Rus								Introduced from Russia in 1879.
Bearnaise. EFABC'00									In trial orchard at Agassiz, B. C.
Beauchamps. GenF'33,196. NAPC'49,38. E'54,354,'59,366. D'57,456,'69,673. T'85,287. Syns. Belle de Brissac, Bergamotte Beauchamps, Burgamotte Bufo, Burgamotte Cadette, Bergamotte Capraud, Beurre Beauchamps, Beurre Cadette, Buerre de Beauchamps, Biemont, Haghens d'Hiver, Nouveau Cours Complet d' Agriculture, Oguonet (incorrectly of some), Poire de Cadet.	Belg	robo	m	yrub	bjmg	s	g	ml	Originated by Dr. John Van Mons.
Beauchamps. F276. Syn. of Bufo									
Beauchamps. Wg66. E'54,354. T'75,537,'85,551,'97,694. Syn. of Cadet									
Beauclerc. D'69,863. Syn. of Bon Chretien (Sum.)									
Beaufort. A'85,153,'87,90. JVL'93,'99,'00. BBL	N. C								Originated at Beaufort, N. C. Named by J. Van. Lindley.
Beaulien L. Syn. Beaurre Beaulien		rp	m	gyrn	gbm	v	g	m	
Beaumont. Cult'47,340. Syns. Abbe de Beaumont, Belmont, Beurre Beaumont, Beurre Biemont, Beurre de Beaumont, Beymont, Bezy de St. Wast, Bezy Waet.	Fr	obtp	m	gyr	jm	vs		me	Originated by Andre Leroy, of Angers, France.
Beau Present. Pr152. GenF'37,227. D'45,337,'57,514,'69,758. E'54,373,'59,393. F280. Syn. of Jargonelle (Eng.).									
Beau Present d'Artois. MagofH'51,542. B'51,299. MassH'53,21. E'54,354,'59,365. D'57,563,'69,668. F276. IllH'63,22. T'75,537,'85,551,'97,694. EFABC'00. Syn. of Artois.									

Beau Present Epargne. CanExFR'95,392. EFABC'00. Syn. of Jargonelle (Eng.)									
Beaureal. R. Syn. Beurre Beaureal									Exhibited by Col. M. P. Wilder in 1848.
Beauraing. R. Syn. Incomparable de Beauraing	Belg.	obtp	l						Raised by M. Gregoire. Resembles Diel.
Beaute de Tervueren. D'57,537,'69,835. Syn. of Pound									
Beauty of Autumn. Pr64. K'32,141,'41,122. Syn. of Brussels									
Beauty of Brussels. Pr159. D'69,668. Syn. of Brussels									
Beauty of Summer. Pr30. MagofH'41,157. MichB187,194. Syns. Belle d'Ete, Bellissime d'Ete de Provence.		rp			co	s		me	This is probably Windsor. See Bulletin of the Michigan Agricultural Experiment Station, 194, p. 50.
Beauty of Summer. Pr26. K'32,126,'41,118. Syn. of Beauty (Sum.)									
Beauty of Summer. C179. SW. H124. F280. Syn. of Jargonelle (Fr.)									
Beauty of Turvensen. F283. Syn. of Pound									
Beauty of Winter. Pr112. K'41,125. MassH'46,151. MagofH'50,295. Cult'50,450. A'54,237. Syn. of Du Bur.									
Beauty (Sum.). L. Syns. Beauty of Summer, Bellissime d'Ete, Bellissime or Super-fair, Muscadelle-Rouge, Poire Figue, Red Muscadel, Red Muscadelle, Summer Beauty, Supreme, The Fairest or Supreme.	Fr.	rp		gyr	m	s		e	Imported by William R. Prince prior to 1831.
Beauvalot. D'57,[illegible],'69,667. Syns. Auger, Augert, Augiere	Eur.	obtp	ml	j	v	p		l	Downing says, "A foreign variety of inferior quality."
Bec d'Oie. F278. Syn. of Angleterre									
Bedford. R. Syn. Duc de Bedford									Published in Magazine of Horticulture, 1855, p. 146.
Bedman. L. Syns. Marquis de Bedman, Marquise de Bedman	For.	rp	ms	ygru	b	s	g	me	
[illegible] Gratioli. D'69,791. Syn. of Gratioli									
Beguines. L. Syns. Beurre des Beguines, Beurre Beguines	Belg.	obo	s	ru	jgm	s	g	m	Raised by Dr. John Van Mons, of Louvain.
Bein Armudi. GenF'33,198. K'41,121. D'45,368,'57,475,'69,700. E'54,355,'59,367. F278. Syn. of La Motte.									
Belges. L. Syn. Reine des Belges	For.								Published in Field's undescribed list.
Bell. Cult'39,66. Syn. of Catillac									
Bell. Cole154. AgR'55,296. Syn. of Windsor									
Bell de Martigny. MagofH'42,431. Syn. of Martigny									
Belle Adrienne. F283. D'69,875. Syn. of Vicar									
Belle Alliance. MagofH'51,137. F281. Syn. of Serrurier									
Belle Alliance. K'41,135. D'57,458,'69,698. Syn. of Sterkmans									
Belle Andreane. D'69,875. Syn. of Vicar									
Belle Angevine. K'41,155. E'54,334,'59,346. D'57,537,'69,835. F283. AgR'58,423. AJofHV1,50. CGenX1,320. FGAofO'69,54,'75,61. T'75,537,'85,551,'97,694. EFABC'00. Syn. of Pound.									
Belle Anna. FGAofO'83,72	Eur.								Not described.
Belle Apres Noel. MagofH'48,209,'54,361. MassH'51,189. WHRI,46. E'54,349,'59,370. D'57,490,'69,764. T'75,537,'85,551,'97,694. Syn. of Noel.									
Belle Audibert. Pr119. D'69,662. Syn. of Audibert									
Belle Bessa. Pr120. Syn. of Bessa									
Belle Caennais. MassH'48,97. Syn. of Napoleon									
Belle Caennaise. E'54,350. H122. D'69,819. Syn. of Napoleon									
Belle Candie. D'69,757. Syn. of Jargonelle (Fr.)									
Belle Cornelie. E'59,359. Syn. of Heyst (Eliza)									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

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Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Belle Craonnaise. MassH'48,97. Syn. of Craonnaise.									
Belle d'Aout. Pr150. D'45,334,'57,564,'69,668. E'54,349,'59,418. A'54,237. Syn. of Brussels.									
Belle d'Aout or August. F226. Syn. of Brussels.									
Belle d'Austrasie. D'69,790. Syn. of Jaminette.									
Belle de Beaufort. FGAofO'87,172. E&B'94. EFABC'00. [Perhaps same as Beaufort.]									
Belle de Berry. K'41,159. Cult'47,340. HovI,47. AgR'62,189. D'69,875. Syn. of Vicar.									
Belle de Beauchamps. D'57,456. Syn. of Beauchamps.									
Belle de Brissac. Hort'54,308. F276. Syn. of Bufo.									
Belle de Bruxelles. Cult'48,86. Syn. of Brussels.									
Belle de Bruxelles. Pr150. K'32,153,'41,130. D'45,334,'57,564,'69,668. Hort'47,446. E'54,349,'59,418. AgR'54,249. A'54,237. AJofHVIII,223. H122. F276. T'75,537,'85,551,'97,694. Syn. of Brussels.									
Belle de Bruxelles. GenF'37,277. M'38,76. D'45,353,'57,454,'69,778. MagofH'47,344. AgR'56,365. Syn. of Hampden.									
Belle de Bruxelles Without Kernel. F276. Syn. of Kernel									
Belle d'Ecully. Cult'88,261. Syn. of Ecully									
Belle d'Esquermes. MagofH'54,135. D'69,790. Syn. of Fontenay									
Belle d'Ete. Pr30. Syn. of Beauty of Summer									
Belle d'Ete. D'69,883. Syn. of Windsor									
Belle de Ferron. F226. Syn. of Ferron									
Belle de Figuier. D'69,668. Syn. of Figuier									
Belle de Flandres. M'44,89. D'45,386,'57,438,'69,760. E'54,324,'59,337. AgR'62,184. T'75,537,'85,551,'97,694. B'83,369. Syn. of Flemish.									
Belle de Flushing. F272. D'69,779. Syn. of Harvard									
Belle de Forest. D'69,713. Syn. of Summer Calebasse									
Belle d'Ixelles. F214. Syn. of Easter Beurre									
Belle d'Ixelles. MagofH'60,218. Syn. of Ixelles. [Perhaps distinct from Ester Beurre.]									
Belle de Jersey. E'54,334,'59,346. D'57,537,'69,835. F283. AJofHVI,50. S18. Syn. of Pound.									
Belle de Jersey. D'69,668. Syn. of Thouars									
Belle de Jersey (of the French). K'32,151,'41,129. D'45,448. Syn. of Fonneau									
Belle de L'Orient. D'69,668. Syn. of L'Orient									
Belle de Luxembourg. D'69,778. Syn. of Hampden									
Belle de Moire. D'69,691. HHI'69,156. Syn. of Moire									
Belle de Noel. E'54,349,'59,359. AgR'56,329. D'57,499,'69,764. T'75,537,'85,551,'97,694. Syn. of Noel.									
Belle de Prague. D'69,668. Syn. of Thouars									
Belle des Abres. HH'79,325. AofH'92,276. EFABC'00. Syn. of Abres.									
Belle des Bois. F280. D'69,760. Syn. of Flemish									

Belle de Stresa. EFABC'00. Syn. of Stresa.									
Belle de Thouars. K'41,169. E'54,350,'59,359. H124. F279. D'69,668. Syn. of Thouars.									
Belle de Thouarse. AgR'54,243. D'69,668. Syn. of Thouars.									
Belle de Troyes. D'69,668. Syn. of Thouars.									
Belle de Vitry. K'41,169. Syn. of Vitry.									
Belle du Plessis. F276. Syn. of Plessis.									
Belle du Vernie. D'69,736. Syn. of Devergnies.									
Belle du Vernis. D'69,736. Syn. of Devergnies.									
Belle E. Cully. NJH'06,46. Syn. of Cully.									
Belle Epine Damon. A'58,184. Syn of Damon.									
Belle Epine Dumas. MagofH'50,343. D'57,454,'69,668. F193. E'59,360. A'62,66. T'75,537,'85,551,'97,691. B'83,374. Syn. of Dumas.									
Belle Epine Dumas. E'54,344. Syn. of Vicar.									
Belle et Bonne. Pr99. GenF'33,196. FGAofO'70,20. Syn. of Colmar.									
Belle et Bonne. Pr128. K'32,160,'41,135. GenF'37,277. M'38,75,'44,62. Cult'39,66. D'45,353,'57,454,'69,778. MagofH'47,314. Cole160. E'54,389,'59,417. H124. F276. T'75,537,'85,551,'97,694. Syn. of Hampden.									
Belle et Bonne d' Ezee. HovI,29. D'57,477,'69,705. F274. Syn. of Ezee.									
Belle et Bonne de Hee. K'41,135. MagofH'42,165. NAPC'49,38.	Fr.	r	m	gyru	m	spr	vg	m	
Belle et Bonne d' Hiver. D'69,723. Syn. of Colmar.									
Belle et Bonne des Zees. B'51,313. Syn. of Ezee.									
Belle Excellente. E'54,349,'59,359. D'57,494,'69,747. H122. F283. T'85,281. Syn. of Brabant.									
Belle Favorite. IllH'67,153.							vg		Reported by D. Wilmot Scott, of Galena, Ill., as very fine.
Belle Fertile. DomEncIV,187. Syn. of Blessed.									
Belle Fleurusienne (Bivort). MagofH'54,235. Syn. of Fleurusienne.									
Belle Fondante. D'57,454. F276. E'59,368. T'75,537,'85,552,'97,694.		t	m	yru	bj	v		m	
Belle Gabrielle. K32,141,'41,123. E'54,389,'59,417. D'69,658. Syn. of Ambrette.									
Bellegarde. D'69,772. Syn. of Gilogil.									
Belle Heleres. F283. Syn. of Vicar.									
Belle Heloise. Cult'47,340. HovI,47. D'69,875. Syn. of Vicar.									
Belle Heloise Clion. HovI,47. F220. Syn. of Vicar.									
Belle Henrietta. K'41,135. MagofH'42,431. D'69,782. Syn. of Henrietta.									
Belle Inexagore. Hort'57,189. CGenIX,159. Syn. of Inexagore.									
Belle Julie. E'54,350,'59,360. D'57,454,'69,668. H123. F276. T'75,537,'85,552,'97,694. Syn. of Julie.									
Belle Lucrative. Pr198. K'32,160,'41,135. M'38,75,'44,61,'47,68. Cult'39.66. D'45,387,'57,438,'69,762. AgR'50,95,'53,279,'54,293. B'51,304,'83,366. E'54,312,'59,325. Wg66. HovI,41. A'62,66. AHortA'68,78. T'75,268,'85,287,'97,466. S90. Syn. of Lucrative.									
Belle Moulinoise. D'69,669. Syn. of Moulinoise.									
Belle Noisette. GenF'33,197. D'69,669. Syn. of Du Bur.									
Belle of Brussels. Cole154. APC'50,11. Wg66. E'54,349,'59,418. Syn. of Brussels.									
Belle of Flanders. MagofH'42,61. Syn. of Flandre.									
Belle Rouennaise. D'69,669. Syn. of Rouennaise.									
Belle Sans Pepins. D'69,778. Syn. of Hampden.									
Belle Verge. D'57,514,'69,758. F280. E'59,393. Syn. of Jargonelle (Eng.)									
Belle Vernie or Vernis. F276. Syn. of Devergnies.									
Belle Williams. A'62,110. AgR'62,192. D'69,669. CGenXXV,94. T'75,537,'85,552,'97,694. IllH'96,204. Syn. of Williams.									
Bellissime. K'32,153. D'69,883. Syn. of Windsor.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bellissime d'Automne. Pr64. K'32,141,'41,122. AJofHVIII,223. D'69,668. Syn. of Brussels.									
Bellissime d' Ete. Pr26. Syn. of Beauty (Sum.)									
Bellisime de Provence. D'69,847. Syn. of Stuttgart									
Bellisime Du Bur. D'69,669. Syn. of Du Bur									
Bellissime d'Ete. K'32,126,'41,118. D'45,339,'57,514,'69,767. Cole179. E'54,395,'59,421. H124. F276. T'75,537,'85,552,'97,694. Syn. of Jargonelle (Fr.).									
Bellissime d'Ete de Provence. Pr30. Syn. of Beauty of Summer									
Bellissime d'Hiver. Pr112. K'32,142,'41,125. GenF'33,197. Cult'39,66. D'69,669. EFABC'00. Syn. of Du Bur.									
Bellissime d'Hiver du Bur. D'69,835. Syn. of Pound									
Bellissime Jargonelle. D'45,339,'57,514,'69,767 E'54,395,'59,421. F280. T'75,537,'85,552,'97,694. Syn. of Jargonelle (Fr.).									
Bellisime or Super-fair. Pr26. Syn. of Beauty (Sum.)									
Bellisime Supreme. D'45,339,'57,514,'69,767. E'54,395,'59,421. F280. Syn. of Jargonelle (Fr.).									
Bell Tongue. D'69,883. Syn. of Windsor									
Bellville Baking. Dap155. Syn. of Harrison									
Belmont. K'32,161,'41,136. GenF'33,197. Cult'39,66. D'45,353,'57,564,'69,669. MagofH'50,'295. A'54,237. E'54,389,'59,417. H123. T'75,537,'85,552,'97,694.	Eng	obtp	l	ygb	gj	s		m	Mainly grown for culinary purposes.
Belmont. Hort'59,294. Syn. of Beaumont									
Beman. R. Syn. Beman's Seedling	Can								Originated at Newcastle, Ontario, Canada.
Beman's Seedling. CanH'03,14,'05,219. Syn. of Beman									
Bencel. R. Syn. Bencel's Winter									Catalogued by Silas Wharton, in 1824.
Bencel's Winter. SW. Syn. of Bencel									
Benefield. CGenXXIV,335. Syn. of Ockletree									
Bennert. L. T'97,694. Syns. Beurre Benner, Beurre Bennert	Belg	roblp	s	ybru	jgm	sp	g	l	
Benoist. E'59,360. T'75,537,'85,552,'97,694. Syns. Auguste Benoist, Benoist, Beurre Auguste Benoist, Beurre Benoist, Beurre Benoist Nouveau.		rp	m	yrru	djm	sp	vg	me	
Benoist Nouveau. E'54,355,'59,367. H125	For	robo	m	gybru	bej	a		vl	
Benoists. F277. A'62,66. Syn. of Benoist									
Bensell. L. Syn. Bensell's Winter	Penn	r	l	y	bj	a		l	Originated by Mr. Bensell, near Philadelphia, Pa.
Bensell's Winter. C210. H124. Syn. of Bensell									
Benvie. R. Syns. Benvie Autumn, Benvie Summer									Published in Magazine of Horticulture, 1843, p. 130.
Benvie Autumn. MagofH'43,130. Syn. of Benvie									
Benvie Summer. MagofH'43,130. Syn of Benvie									
Bequene. Pr105. Syn. of Bequesne									
Bequesne. C202. Pr105. K'32,153,'41,123. H125. Syns. Bequene, Bequesne Musque.		p	l	y		a		vl	Valued for cooking.

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Bequesne. Pr85. Syn. of Provence									
Bequesne Musque. GenF'33,197. Cult'39,66. Syn. of Bequesne									
Berckmans. L. Syns. Alexandre Berckmans, Beurre Berckmans	Belg	obop	ml	yru	jbm	p	vg	m	Originated by Maj. Pierre Joseph Esperen, Malines, Belgium.
Bere Blanche de Lifland. CanH'94,291. Syn. of Lifland									
Bere Verte de Lifland. CanH'94,291. Syn. of Lifland									
Bergamota. CalSBofH'92,49	Cal								An old native California variety.
Bergamot (Aut.). F277. Syns. Autumn Bergamot, Autumn Burgamot, Bergamotte d'Automne, Common Bergamot, English Autumn Bergamot, English Bergamot, French Autumn Bergamot, Heere pear, Ruddy English Bergamot, York Bergamot.		rob	s	gybru	cgj	sp	g	me	
Bergamot Bufo. F276. Syn. of Bufo									
Bergamot Cadet. Pr76. Syn. of Cadet									
Bergamot Crassane. Thl86. E'54,393,'59,420. Syn. of Crassane									
Bergamot d'Hiver. Pr77. K'32,142. GenF'37,278. E'54,389. F277. CanH'94,291. Syn. of Easter Bergamot.									
Bergamot Easter. E'54,389. F277. T'85,552. Syn. of Easter Bergamot									
Bergamote a Feuilles Panachees. F276	For								In Field's undescribed list.
Bergamote Crassanne. K'41,122. F276. Syn. of Crassane									
Bergamote Crassanne d'Ete. F276	For								Do.
Bergamote d'Angleterre. F276	For								Do.
Bergamote d'Automne. F276. Syn. Grosse Ambrette	For								Do.
Bergamote d'Ertrycher. F276	For								Do.
Bergamote d'Ete. F276. CanExFR'03,421. Syns. Beurre blanc or White, Beurre d'Ete, Beurre Ronde, Milan Blanc, Milan de la Beuvriere, Bouille Bouche.		obtp	m	ybr	jbm	s	g	me	In experimental orchard at Agassiz, B. C.
Bergamot d'Ete. D'45,333. E'59,422. Syn. of Hampden									
Bergamote d'Ete Panachee. F276	For								In Field's undescribed list.
Bergamote de Heimbourg. F277. Syn. of Heimbourg									
Bergamote Drouet. F276. Syn. of Drouet									
Bergamote Dussart. F276. Syn. of Dussart									
Bergamote Esperen. F277. B'83,279. AofH'90,202. Syn. of D'Esperen									
Bergamot Fieve. MagofH'54,176. Syn. of Fieve									
Bergamot Gansel's. Wg66. Syn. of Gansel Bergamot									
Bergamot Hampden's. Wg66. F277. T'85,552. Syn. of Hampden									
Bergamot Heltrich. EFABC'00. WNYH'05,140									Exhibited by Ellwanger & Barry at meeting of Western New York Horticultural Society, 1905, p. 140.
Bergamot Krasnui. Gb. Syn. of Red Bergamot									
Bergamot Kurski. Gb. Syn. of Kursk									
Bergamot la Gauloise. EFABC'00. Syn. of Gauloise									
Bergamot Lageret. F277. Syn. of Lageret									
Bergamot Liaband. EFABC'00									In experimental orchard at Agassiz, B. C.
Bergamot Libbitent Verte. MagofH'52,474. Syn. of Libbitent									
Bergamot Lott's. Syn. Lott's Bergamot									Listed by Kenrick as a baking variety.
Bergamot Louvain. MagofH'55,185		r	m	yru			g	m	
Bergamot osennii. Gb. Syn. of Autumn Bergamot									
Bergamot paskale. Pr53. Syn. of Easter Beurre									
Bergamot Philippot. EFABC'00. Syn. of Philippot									
Bergamot (Platt). K'41,130. Syn. of Platt's Bergamot									Not described.
Bergamot ploskui. Gb. Syn. of Flat Bergamot									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bergamot rannaya. Gb. Syn. of Early Bergamot									
Bergamot rannui. Gb. Syn. of Early Bergamot									
Bergamont Rayee. Pr74. D'69,865. Syn. of Swiss Bergamot									
Bergamot Sapieganka. Gb. Syn. of Sapieganka									
Bergamot Seckel. D'69.671	Eng.	r	ms	rbru	j	sp			Raised by William Pitmaston, of England.
Bergamont Suisse. GenF'33,196. F277. Syn. of Suisse									
Bergamont Suisse. Cult'39,66. E'54,400, '59,424. Syn. of Swiss Bergamot									
Bergamot Summer. F277. T'85, 552. Syn. of Summer Bergamot									
Bergamot Sylvanche. Pr77. D'69,866. Syn. of Sylvange									
Bergamot Sylvange. E'54,400. Syn. of Sylvange									
Bergamot Vsduti. Gb. Syn. of Vsduti									
Bergamot Zelenui. Gb. Syn. of Green Bergamot									
Bergamotte. E'59,403. Syn. of Portugal									
Bergamotte Beauchamp. Syn. of Beauchamps									
Bergamotte Boussiere. E'54,396. '59,418. D'69,669. Syn. of Boussiere									
Bergamotte Bufo. D'57,456. E'59,366. Syn. of Beauchamps									
Bergamotte Bufo. D'69,670. Syn. of Bufo									
Bergamotte Cadet. Wg66. D'69,670. Bl228,234. Syn. of Cadet									
Bergamotte Cadette. K'41,121,136. D'45,367,'57,456. B'51,303. E'54,354,'59,366. T'75,269,'85,287,'97,466. Syn. of Beauchamps									
Bergamotte Cadette. F276. MoH'03,85. Syn. of Bufo									
Bergamotte Cheminette. F281. D'69,790. Syn. of Jaminette									
Bergamotte Capraud. D'57,456. Syn. of Beauchamps									
Bergamotte Crapaud. K'41,137. MagofH'48,205. H134. E'59,366. D'69,670. Syn. of Bufo									
Bergamotte Crassane. GenF'33,196. D'45 375,'57,571,'69,729. Syn. of Crassane									
Bergamotte Crassane d'Automne. D'69,729. Syn. of Crassane									
Bergamotte Crassane de Bruneau. D'69,676. Syn. of Bruneau									
Bergamotte Crassane d'Hiver. D'69,676. Syn. of Bruneau									
Bergamotte Crassanne. K'41,122. Syn. of Crassane									
Bergamotte d'Alencon. D'45,430,'57,564,'69,784. E'54,389,'59,417. F277. Syn. of Hollande.									
Bergamont d'Angleterre. D'45,333,'57,565'69,778. E'54,396,'59,422. F277. Syn. of Hampden.									
Bergamotte d'Angleterre. Pr68. Syn. of Summer Bergamot									
Bergamot d'Automne. M'38,86,'44,73. K'41,121. A'54,237. CanH'94,291. Syn. Autumn Bergamot.		rob	s	ygb	js	p		me	Manning says, "distinct from Autumn Bergamot."
Bergamotte d'Automne. Pr70. Syn. of Bergamot (Aut.)									
Bergamotte d'Automne. MHSC'82,57. FGAofO'83,221. CanH'94,291. Syn. of Red Bergamot.									
Bergamotte d'Avranches. Hov1,39. AgR'62,185. D'69,805. Syn. of Louise									

Bergamotte de Bruxelles. D'69,778. Syn. of Hampden									
Bergamotte de Bugi. Pr77. GenF'37,278. D'45,429,'57,564,'69,751. E'54,389,'59,417. F277. Syn. of Easter Bergamot.									
Bergamotte de Cadette. K'32,133. Syn. of Cadet									
Bergamotte de Careme. D'69,751. Syn. of Easter Bergamot									
Bergamotte d'Esperen. MagofH'48,209,'54,461. AJofHIX,377. EFABC'00. Syn. Bergamotte Esperen.							g	1	Not described.
Bergamotte d'Esperen. D'57,455,'69,670. H135. F277. AgR'58,405. T'75,537,'85,552,'97,695. Syn. of D'Esperen.									
Bergamotte d'Esperin. E'54,354,'59,366. Syn. of D'Esperin									
Bergamotte d'Ete. E'54,396. D'57,565. F277. T'75,538,'85,552,'97,695. Syn. of Hampden.									
Bergamotte d'Ete. Pr68. GenF'37,277. K'41,120. D'69,862. EFABC'00. Syn. of Summer Bergamot.									
Bergamotte d'Ete Grosse. D'69,778. Syn. of Hampden									
Bergamotte d'Ete ou Milan Blanc. K'41,120. D'69,863. Syn. of Franc Real (Sum.)									
Bergamotte de Flandre. F201,280. D'69,760. Syn. of Flemish									
Bergamotte de Fougere. D'45,430,'57,564,'69,784. E'54,389,'59,417. F277. Syn. of Hollande.									
Bergamotte de Hampden. Pr68. Syn. of Summer Bergamot									
Bergamotte d'Hiver. D'45,429,'57,564. E'59,417. CanH'94,291. Syn. of Easter Bergamot.									
Bergamotte d'Hiver d'Holland. D'69,784. Syn. of Hollande									
Bergamotte d'Hollande. K'32,146,'41,126. D'45,430,'57,564,'69,784. E'54,389,'59,417. F277. T'75,538,'85,552,'97,695. Syn. of Hollande.									
Bergamotte d'Holland d'Alencon. GenF'37,278. Syn. of Holland									
Bergamotte de Kursk. CanH'94,291	Rus.?								Tree not hardy in Canada.
Bergamotte de la Grilliere. D'69,751. Syn. of Easter Bergamot									
Bergamotte de la Pentecote. K'32,193,'41,160. GenF'37,278. D'45,425,'57,428,'69,751. E'54,317,'59,331. T'75,537,'85,552,'97,695. Syn. of Easter Beurre.									
Bergamotte de Mallnes. F277	For.								In Field's undescribed list.
Bergamotte de Millepieds. MagofH'57,301. F277. E'59,368. A'69,88. AHortA'69,71. T'75,537,'85,552,'97,695. Syn. of Millipieds.									
Bergamotte de Millipieds. D'57,457,'69,670. T'85,552. Syn. of Millipieds									
Bergamotte d'Oisan. Hort'57,189. CGenIX,159. Syn. of Oisan									
Bergamotte de Paques. K'32,142,'41,124. D'45,429,'57,564,'69,751. E'54,389,'59,417. MagofH'54,456. F277. Syn. of Easter Bergamot.									
Bergamotte de Pasques. Pr77. GenF'37,278. Syn. of Easter Bergamot									
Bergamotte de Parthenay. K'41,131. D'69,671. Syn. of Parthenay									
Bergamotte de Paysans. D'69,778. Syn. of Hampden									
Bergamotte de Soulers. Pr78. K'32,142,'41,125. D'57,488,'69,706. T'75,537,'85,552,'97,695. Syn. of Soulers.									
Bergamotte des Paysans. K'32,161									Possibly same as Hampden.
Bergamotte de Toulouse. D'45,429,'57,464,'69,751. E'54,389,'59,417. F277. Syn. of Easter Bergamot.									
Bergamotte de Voronege. CanH'94,291. Syn. of Voronege									
Bergamotte Doree. D'69,841. Syn. of Red Bergamot									
Bergamotte Drouet. MagofH'52,298. WHRH,559. Syn. of Drouet									
Bergamotte Dussart. MagofH'52,298. WHRH,559. D'69,670. Syn. of Dussart									
Bergamotte Esperen. MagofH'57,158. Syn. of Bergamotte d'Esperen									
Bergamotte Fievee. D'57,439,'69,762. F194,276. AgR'62,179. Syn. of Lucrative									
Bergamotte Fortunee. MagofH'50,295. A'54,237. D'57,573,'69,766. F280. Syn. of Fortunee.									

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Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bergamotte Gansel's. F277. Syn. of Gansel Bergamot.									
Bergamotte Gaudry. Hort'53,65. E'51,354,'59,366. D'57,455,'69,670. H135. F277. MassH'58,71. MagofH'39,41. T'75,538,'85,552,'97,695. Syn. of Gaudry.									
Bergamotte Gerard. D'69,772. Syn. of Gilogil.									
Bergamotte Hambourg. MagofH'54,455. E'59,360. Syn. of Heimbourg.									
Bergamotte Heimbourg. MagofH'35,189. D'57,455,'69,671. E'59,368. T'75,538,'85,552,'97,695. Syn. of Heimbourg.									
Bergamotte Incomparable. MassH'62,32.	Mass.								Fruit from the first tree at Boston, Mass., 1862.
Bergamotte Lesble. MagofH'52,157. D'57,456,'69,671. E'59,368. T'75,538,'85,552,'97,695. Syn. of Leseble.									
Bergamotte Lese[illegible]. F277. Syn. of Leseble.									
Bergamotte Libbeden. MassH'17,69.									Exhibited by Robert Manning, September, 1817.
Bergamotte Louise. D'57,520,'69,802. T'85,281. Syn. of [illegible].									
Bergamotte Luc. F191. Syn. of Lucrative.									
Bergamotte Lucrative. HovI,41. F276. D'69,762. Syn. of Lucrative.									
Bergamotte [illegible]. D'69,776. Syn. of Groom.									
Bergamotte Musque. D'69,841. Syn. of Red Bergamot.									
Bergamotte of Soulers. Pr78. Syn. of Soulers.									
Bergamotte Ordinaire (of Warsaw). Gb. Syn. of Warsaw.									
Bergamotte Osenii (of Regel). FGAofO'83,220. Syn. of Autumn Bergamot.									
Bergamotte Parthenay. MassH'45,88. MagofH'49,156. E'54,390,'59,417. D'69,671. AJofHVII,332. Syn. of Parthenay.									
Bergamotte Pastel. MagofH'35,146. Syn. of Pasteel.									
Bergamotte Piquot. MassH'51,189. D'69,671. Syn. of Piquot.									
Bergamotte Ploskui. IaH'80,61. Syn. of Ploskui.									
Bergamotte Poiteau. D'69,671. Syn. of Parthenay.									
Bergamotte Precoce. Pr49. Syn. of Early Bergamot.									
Bergamotte Quessoy d'Ete. D'69,700. Syn. of Caissoy d'Ete.									
Bergamotte Reinette. MagofH'40,219. Syn. of Reinette.									
Bergamotte Ronde d'Hiver. D'69,751. Syn. of Easter Bergamot.									
Bergamotte Rose. F277.	For.								In Field's list of undescribed varieties.
Bergamotte Rouge. Gb. FGAofO'92,97.	Rus?								Introduced from Russia in 1882.
Bergamotte Rouge. Pr68. K'32,126,'41,120. D'69,841. Syn. of Red Bergamotte.									
Bergamotte Rouge Tardy. D'69,782. Syn. of Henri Van Mons.									
Bergamotte Royal d'Hiver. D'69,723. Syn. of Colmar.									
Bergamotte Sageret. D'57,455,'69,671. Syn. of Sageret.									
Bergamotte Sanspareil. D'57,476,'69,702. F278. Syn. of Sanspareil.									
Bergamotte Sapieganka. IaH'80,61,'82,83.	Rus.								Recommended by Prof. Budd.
Bergamotte Seedling. MassH'66,45.	Mass.								Shown by Dr. S. A. Shurtleff, of Brookline, Mass.

Bergamotte Sieulle. D'57,435,'69,746. F240. E'59,378. AgR'65,190. Syn. of Sieulle.									
Bergamotte Soldat Labourer. D'69,751. Syn. of Easter Bergamot.									
Bergamotte [illegible]. D'69,671. Syn. of Parthenay.									
Bergamotte Suisse. H135. Syn. of Suisse.									
Bergamotte Suisse. Pr74. K'41,121. D'45,367,'57,501,'69,865. T'75,558,'85,552,'97,695. Syn. of Swiss Bergamot.									
Bergamotte Sylvange. Pr77. GenF'37,277. K'41,126. D'45,413,'57,583,'69,866. H195. F283. T'85,572. Syn. of Sylvange.									
Bergamotte Tardive. Pr99. K'32,144. GenF'37,278. D'69,723. Syn. of Colmar.									
Bergamotte Thouin. D'69,884. Syn. of Winter Nelis.									
Bergamotte Zappa. A'54,237. Syn. of Zappa.									
Bergen. D'57,454,'69,671. MagofH'58,507. Hort'58,221,'61,157. AgR'68,426. A'58,56,'64,65. Bul6. Syn. Bergen Pear.	N. Y.	obtp	l	yb	gbjm	sp	g-vg	m	Originated on Long Island.
Bergen Pear. E'59,368. T'75,259,'85,277,'97,459. Syn. of Bergen.									
[illegible]. D'69,829. Syn. of Passe Colmar.									
Bergia. L. Syns. François, François Bergen, Saint François.	Fr.	obt	m	yru	coj	v	p	m	Described by Hogg as François Bergia.
Bergler. MagofH'43,130.									Not described.
[illegible]. D'45,278,'57,436,'69,390. E'51,322,'59,336. F224,279. Syn. of White Doyenne.									
Berkett. IllH'73,343. Syn. of Burkett.									
Berlin. K'41,130. MagofH'43,130.									Called an outcast by Kenrick.
Bernard. Cult'47,340.									Not described.
Berri. L. Syns. Duchesse de Berri, Duchesse of Berri, Duchesse of Berry, Souvenir d'Ete.	Eur.	robo	m	yru	comj	s		m	
Berriays. D'69,672. T'75,538,'85,552,'97,695. Syns. Abbe le Berriays, Poire de Berriays.	Fr.	robt	m	gyb	gjm	v	g-v	me	Originated by M. Boisbunel in 1861.
Berry. L. Syns. Duchesse de Berri d'Ete, Duchesse de Berry, Duchesse de Berry d'Ete, Duchesse de Berry de Nantes.	Fr.	roblp	s	yru	jm	v	g-vg	e	Originated at Nantes, France.
[illegible]. D'69,[illegible]. Syn. of Pound.									
Bertrand. R. Syn. Bertrand Guinoisseau.									Exhibited by Col. M. P. Wilder.
Bertrand Guinoisseau. MassH'74,152. Syn. of Bertrand.									
Besberry. C212.									Not described; grown for perry.
Besi Cesarine. EFABC'00.									In the collection at Agassiz, B. C.
Besi Chaumontel. Pr94. Syn. of Chaumontel.									
Besi d'[illegible]. K'41,123. D'69,700. Syn. of Heri.									
Besi de Bretagne. D'69,700. Syn. of Caissoy.									
Besi de Caissoy. Pr125. Syn. of Caissoy.									
Besi de Chaumontel. F278.	For.								In Field's list of undescribed varieties.
Besi de Chaumontel. Pr94. Syn. of Chaumontel.									
Besi de Chaumontel. (Var.) F278.	For.								Do.
Besi de Heri. DuhEncIV,190. Syn. of Heri.									
Besi de la Motte. Pr79. AHM234. Syn. of La Motte.									
Besi de la Pierre. D'69,701. Syn. of Pierre.									
Besi de Mai. MagofH'60,153. D'69,702. Syn. of Mai.									
Besi de [illegible]. D'69,716. Syn. of Catillac.									
Besi de Montigny. MagofH'45,130. WHRI,166. B'83,379. Syn. of Montigny.									
Besi de Quessoy. D'69,700. Syn. of Caissoy.									
[illegible]. Pr96. Syn. of Heri.									
[illegible]. [illegible] K'32,134,'41,123. D'69,700. Syn. of Heri.									
[illegible]. Pr124. K'32,144. Syn. of Echasserie.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Besidery Sandry. Pr124. K'32,144. D'69,753. Syn. of Echasserie									
Besi de St. Waast. D'69,702. EFABC'00. Syn. of Vaet									
Besi de Vindre. F278. Syn. of Vindre									
Besi du Caissoy or Quessoy. F278. Syn. of Caissoy									
Besi Esperen. D'69,701. B'83,379. Syn. of Bezi Esperen									
Besi Fondante. F280. D'69,777. Syn. of Hamon									
Besi Hamon. D'69,777. Syn. of Hamon									
Besi Incomparable. F278. D'69,702. Syn. of Sanspareil									
Besi Liboutton. F278. Syn. of Liboutton									
Besi Quessoy d' Ete. MagofH'57,259. D'69,700. T'85,555. Syn. of Caissoy d'Ete									
Besi Rosman. F278. Syn. of Rosman									
Besi Va. D'69,702. Syn. of Vaet									
Besi Vaat. D'69,702. Syn. of Vaet									
Besi Vath. D'69,702. Syn. of Vaet									
Besi Waet. D'69,702. Syn. of Vaet									
Bessa. L. Syn. Belle Bessa				gyru				l	From New Duhamel.
Bessemianka. Gb. MHSC'82,53,'83,117. IaH'82,83,'84,312,'85,321. A'83,73 '87,94. IndH'85,27,'88,44. FGAofO'83,219. OH'87,165. HAJ'88,62. N251. IllH'90,126,'92, 172,'94,137,'96,45. Bul6,8. AHM234. Syns. Bessimianka, No508, Samenlose, Seedless.	Rus	robo	m	y	jg	s	g	me	Introduced from Russia in 1879.
Bessemianka Ordinaire. CanH'94,291									Possibly the same as Bessemianka.
Bessimianka. BBCo. Syn. of Bessemianka									
Best. R. Syn. Best's Favorite									On trial at Illinois Experiment Station No. 1.
Best's Favorite. IllH'96,178,186,'04,223. BBL. Syn. of Best									
Best Winter. A'73,111									Not described.
Bethlehem. R. Syn. Star of Bethlehem	Pa?								Published in the Horticulturist, 1869, p. 334.
Betzelsbirn. MHSC'85,26		r	m	y			p	ml	A culinary and perry pear.
Beucke. R. Syn. Beurre Beucke									In the experimental orchard at Agassiz, B. C.
Beurre. GenF'33,196. K'41,120. D'45,357,'57,471,'69,710. E'54,350,'59,360. Syn. of Brown.									
Beurre Adam. MagofH'47,437. A'54,237. E'54,391,'59,418. Syn. of Thumb									
Beurre Adlem. MichH'76,143. Syn. of Adlem									
Beurre a la Reine. D'69,818. Syn. of Muscat Robert									
Beurre Amande. D'57,466,'69,661. F277. T'75,538,'85,552. EFABC'00. CanExFR '03,421. Syn. of Angleterre.									
Beurre Amanlis. Bul6. Syn. of Amanlis									
Beurre Ananas. A'75,68. T'75,538,'85,552. Dap155. Syn. of Ananas									
Beurre Ananas. Cult'47,340. D'57,507,'69,782. F280. E'59,390. Syn. of Henry IV									
Beurre Andusson. Hort'51,114. A'54,237. H132. Syn. of Audusson									

Beurre Anna Audisson. D'69,661. Syn. of Audisson

Beurre Antoine. D'69,672. Syn. of Antoine

Beurre Antoinette. MassH'58,74. D'69,672. Syn. of Antoinette

Beurre Assomption. D'69,672. T'85,552. WnI,325,II,335. Syn. of Assomption

Beurre Audusson. E'54,353,'59,366,407. D'57,540. F282. T'75,538,'85,552. Syn. of Ridelle.

Beurre Audusson d'Hiver. D'69,682. Syn. of Defais

Beurre Auguste Benoist. D'57,467,'69,674. E'59,360,364. Syn. of Benoist

Beurre Auneniere. D'69,673. Syn. of Auneniere

Beurre Aurore. Cult'47,340. D'57,473,'69,682. E'59,369. Syn. of Capiaumont

Beurre Bachelier. MassH'53,17. E'54,353,'59,363. D'57,458,'69,673. AHortA'68,78. T'75,259,'85,277. AofH'90,202. Syn. of Bachelier.

Beurre Baguet. MassH'71,41. AJofHVIII,228. Syn. of Baguet

Beurre Bailey. D'69,673. Syn. of Bailey

Beurre Baltet. Hort'73,37. Syn. of Baltet

Beurre Baltet Pere. IaH'79,325. EFABC'00. Syn. of Baltet Pere

Beurre Basce. WHRIV,165. [Perhaps Bosc.] Syn. of Basce

Beurre Beauchamps. GenF'33,196. Cult'39,66. D'45,367,'57,456,'69,673. B'51,303. E'54,354,'59,366. T'85,287. Syn. of Beauchamps.

Beurre Beauchamps. F276,277. Syn. of Bufo

Beurre Beauchamps. Hort'49,455. E'54,354. T'75,538,'85,553. Syn. of Cadet

Beurre Beaulieu. MassH'48,97. E'54,350,'59,360. D'57,467,'69,673. H133. F277. T'75,538,'85,553. Syn. of Beaulieu.

Beurre Beaumont. MagofH'57,550. Syn. of Beaumont

Beurre Beaumont. HovI,89. AgR'51,243. Syn. of Lefevre

Beurre Beaumont. F278. Syn. of Vaast

Beurre Beaureal. MassH'48,97. Syn. of Beaureal

Beurre Beguines. D'69,673. Syn. of Beguines

Beurre Benner. MagofH'52,299. WHRII,559. Syn. of Bennert

Beurre Bennert. D'57,467,'69,674. E'59,362. T'75,538,'85,553. Syn. of Bennert

Beurre Benoist. B'51,313. AgR'56,345. D'57,467,'69,674. E'59,360,364. A'62,66. T'75,538,'85,553. EFABC'00. Syn. of Benoist.

Beurre Benoist Nouveau. D'69,674. Syn. of Benoist

Beurre Berckmans. MassH'53,21. MagofH'54,86. D'57,465,'69,674. E'59,365. F277. AHortA'68,78. T'75,269,'85,287. Syn. of Berckmans.

Beurre Beucke. EFABC'00. CanExFR'02,379. Syn. of Beucke

Beurre Biemont. Hort'54,306. Syn. of Beaumont

Beurre Bieumont. D'57,474. F277. T'85,289. Syn. of Beymont

Beurre Blanc. Pr48. D'69,863. Syn. of Franc Real (Sum.)

Beurre Blanc. DomEncIV,180. GenF'33,196. K'41,121. D'45,378,69,880. HovII, 85. E'54,322,'59,336. AgR'62,183. T'75,538,'85,553. Syn. of White Doyenne.

Beurre Blanc de Jersey. K'32,134,'41,121. GenF'33,198. D'45,368,'57,475,'69,760. E'54,355,'59,367. F278. Syn. of La Motte.

Beurre blanc de Livonie. FGAofO'92,97,109. Syn. of Livonie

Beurre Blanc de Nantes. Cult'47,340. D'57,457,'69,685. F277. Syn. of Nantes

Beurre Blanc des Capucins. F276. D'69,657. Syn. of Amadotte

Beurre Blanc or White. F276. Syn. of Bergamote d'Ete

Beurre Blumenbach. FGAofO'92,110. Syn. of Blumenbach

Beurre Boisbunel. MagofH'60,218. D'69,674. Syn. of Boisbunel

Beurre Boisfunel. F278. Syn. of Boisbunel

Beurre Bollwiller. D'57,566,'69,674. T'75,538,'85,553. Syn. of Bollwiller

Beurre Bon Chretien. D'69,696. Syn. of Rance

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre Bosc. K'32,161,'41,136. GenF'33,196. M'38,80'44,59,'47,67. Cult'39,66. D'45,358,'57,426,'69,674. Cole161. AgR'50,95,'53,279,'54,250. B'51,302,'83,366. HovI,65. E'54,315,'59,329. Wg66. T'75,259,'85,277. A62,66. AJofHVI,145. CanH'78,69. Syn. of Bosc.									
Beurre Boucquia. K'41,146. D'45,355,'57,567'69,707. E'54,391,'59,419. F278. Syn. of Boucquia.									
Beurre Boussock. D'69,742. B'83,361. Syn. of Boussock									
Beurre Bretouneau. E'54,351,'59,363. T'75,538,'85,553. Syn. of Brettouneau									
Beurre Brettouneau. MagofH'48,111,209,'52,299,'54,457. WHRI,46,II,259. B'51,313. E'54,353,'59,363. D'57,468,'69,676. Hort'57,116. H129. F278. T'85,553. Syn. of Brettouneau.									
Beurre Bronzee. D'45,428. E'54,390		r	ml	gru	cj	s	g		Apparently distinct from Naples.
Beurre Bronzee. D'45,388,428,'57,498,'69,760. E'59,418. Syn. of Naples									
Beurre Brougham. F278. Syn. of Brougham									
Beurre Brown. GenF'33,196. B'51,302,'83,378. E'54,350,'59,360. H127. F277. T'75,271,'85,289. Syn. of Brown.									
Beurre Bruneau. Cult'47,340. F278. D'69,676. Syn. of Bruneau									
Beurre Burchardt. D'69,680. Syn. of Aremberg									
Beurre Burnicq. MagofH'75,188. D'57,469,'69,676. F228. T'75,538,'85,553. Syn. of Burnicq.									
Beurre Butter. F238. Syn. of Brown									
Beurre Bymont. E'59,363. Syn. of Bymont									
Beurre Cadet. E'59,360. Syn. of Bufo									
Beurre Cadette. NAPC'49,38. Syn. of Beauchamps									
Beurre Camphrenel. MassH'71,40. Syn. of Camphrenel									
Beurre Canton Horimer. CanExFR'96,135. Syn. of Horimer									
Beurre Capiaumont. MagofH'40,45. B'51,303. E'54,357,'59,369. F278. Syn. of Capiaumont.									
Beurre Catherine. MagofH'43,139. Syn. of Catharine									
Beurre Chapman. D'69,829. Syn. of Passe Colmar									
Beurre Chaptal. Cult'47,340. E'54,358'59,371. D'69,717. Syn. of Chaptal									
Beurre Charneuse. D'57,494,'69,747. F283. T'75,538,'85,553. Syn. of Brabant									
Beurre Charron. E',54,351,'59,360. Hort'54,306. WHRIII,453. H130. F278. D'69,676. Syn. of Charron.									
Beurre Chatenay. D'69,676. Syn. of Chatenay									
Beurre Chandy. AndN'95. EFABC'00. Syn. of Chandy									
Beurre Citron (1). D'57,469,'69,676. F277. T'75,538'85,553,'97,698. Syn. Citron	Belg	obo	ms	yru	mj	sp	g-vg	vl	Originated by Dr. John Van Mons.
Beurre Citron (2). D'69,676		obtp	ms	yru	g		p	l	Not of value.
Beurre Clairgeau. B'51,313,'83,266. HovI,73. E'54,354,'59,166. MagofH'55,87. NWFG'55,41. AgR'56,329. D'57,463,'69,678. A'62,66. CGenXI,28. Cult'58,51, 256. AHortA'68,78. T'75,286,'85,304. WnI,327,II,337,III,279. Syn. of Clairgeau.									
Beurre Clairgleau. MagofH53,40. Syn. of Clairgeau									

Beurre Coit. E'54,319,'59,332. A'62,123,'69,52. AgR'65,189. D'69,722. Syn. of Coit.									
Beurre Colmar. K'32,161. D'45,313,'57,472,'69,678. E'54,390,'59,418. H130. F277. T'75,538,'85,553,'97,698. Syns. Beurre Colmar of Autumn, Beurre Colmar d'Automne, Beurre d'Enghein, Beurre d'Enghien (of France), Colmar d'Automne.	Belg	ov	m	gyr	cjm	p	g	m	Originated by Dr. John Van Mons, of Louvain.
Beurre Colmar d'Automne. D'45,363,'57,472,'69,678. E'54,390,'59,418. Syn. of Beurre Colmar.									
Beurre Colmar dit Precde. K'32,196,'41,164. Syn. of Passe Colmar.									
Beurre Colmar Gris dit Precde. Pr101. GenF'33,197,'37,278. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.									
Beurre Colmar of Autumn. A'54,237. Syn. of Beurre Colmar.									
Beurre Coloma. E'54,357,'59,369. A'54,237. Syn. of Capiaumont.									
Beurre Coloma. F278. Hort'61,315. D'69,678. EFABC'00. Syn. of Coloma.									
Beurre Comice. L. Syn. Beurre Comice de Toulon.		obl	l	y	jm			ml	Possibly identical with Comice.
Beurre Comice de Toulon. E'59,364. T'75,538,'85,553. Syn. of Beurre Comice.									
Beurre [illegible]. D'69,684. Syn. of Koning.									
Beurre Crapaud. GenF'33,196. Cult'39,66. D'45,365. MagofH'48,205. E'54,350,'59,360. H134. Syn. of Bufo.									
Beurre Cullem. D'69,701. Syn. of Montigny.									
Beurre Curte. D'45,371. E'54,360. F278. Syn. of Lamy.									
Beurre Curtet. K'32,162,'41,137. B'51,313. D'57,483,'69,727. F278. E'59,373. Syn. of Lamy.									
Beurre Curtet (of A. Leroy). E'54,361,'59,376. Syn. of Hardenpont (Belg.).									
Beurre Cutter. MagofH'48,97. D'69,727. Syn. of Lamy.									
Beurre Davis. B'51,313.	Fr		l		m			m	Briefly described by Barry, 1851, p. 313.
Beurre Dary. D'69,760. Syn. of Flemish.									
Beurre d'Albret. MagofH'54,234. HovII,65. AgR'56,405. D'57,535,'69,678. F278. E'59,363. B'83,378. T'85,553. EFABC'00. Syn. of Albret.									
Beurre d'Alencon. P173. D'45,430,'57,564,'69,784. E'54, 389,'59,417. F277. T'75,538,'85,553. Syn. of Hellande.									
Beurre d'Amalis. GenF'33,196. Cult'39,66. D'45,360,'69,678. Hort'49,409. AgR'50,95. Wg67. E'54,352,'59,362. H128. F231,277. T'75,269,'85,287. B'83,304. AofH'80,151. Syn. of Amanlis.									
Beurre d'Amalis. T'85,287. Syn. of Beauchamps.									
Beurre d'Amanlis. D'45,360,'57,471,'69,678. E'54,352,'59,362. Syn of Amanlis.									
Beurre d'Amaulis. K'41,136. MagofH'43,369,'50,489. D'45,360,'57,471,'69,678. M'H 87,'47,86. AgR'53,279. E'54,352,'59,312. F277. A'62,66. B'83,378. T'85,287. AofH'60,202. EFABC'00. Syn. of Amanlis.									
Beurre d'Amanlis Panachee. B'51,302. D'69,678. EFABC'00. Syn. of Amanlis Panachee.									
Beurre d'Ambleuse. GenF33,196. D'45,357,'57,471'69,710. E'54,350,'59,360. F277. Syn. of Brown.									
Beurre d'Amboise. GenF'33,196,37,'277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238,277. Syn. of Brown.									
Beurre d'Angleterre. Pr55. K'32,134,'41,121. D'45,351,'57,466,563,'69,661. MagofH'50,295. A'54,237. E'54,388,'59,417. F276,278. B'83,378. EFABC'00. Syn. of Angleterre.									
Beurre d'Anjou. K'41,136. D'45,360,'57,423,'69,679. AgR'50,94 '53,279. B'51,303,'83,396. Wg67. HovI,61. A'52,24. Cult'51,210. E'54,316,'59,330. T'75,270,'85,288. WnI,327,II,337,III,259. Syn. of Anjou.									
Beurre d'Anjou (incorrectly). GenF'33,196. D'45,357,'57,471. F277. Syn. of Brown.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre d'Apremont. Dap155. EFABC'00. Syn. of Bosc.									
Beurre d'Avaudore. D'69,805. Syn. of Louise.									
Beurre d'Ardempont du Printems. Pr54. Syn. of Rance.									
Beurre d'Ardenpont. Pr91. D'69,773. Syn. of Glout Morceau.									
Beurre d'Aremberg. K'32,188,'41,156. GenF'33,196. M'38,95,'44,85,'47,87. Cult'39,66,'46,311. D'45,423,'57,462,'69,680. HovI1. AgR'50,95,'53,279,'54,252. Wg67. B'51,309,'83,375. E'54,314,'59,326. T'75,287,'85,305. Syn. of Aremberg.									
Beurre d'Aremberg (of some). GenF'33,197. D'45,437,'57,503,'69,773. HovI,5. E'54,325,'59,339. F216,280. Syn. of Glout Morceau.									
Beurre d'Arembert. K'32,188. GenF'37,278. Syn. of Aremberg.									
Beurre d'Aremburgh. G85. Syn. of Aremberg.									
Beurre d'Argenson. Pr101. K'32,196,'41,136. GenF'33,196,'37,278. Cult'39,66. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.									
Beurre d'Arlon. EFABC'00. Syn. of Arlon.									
Beurre d'Assomption. AHortA'69,79. EFABC'00. Syn. of Assomption									
Beurre d'Aubitch. EFABC'00. Syn. of Aubitch.									
Beurre d'Austerlitz. F214. Syn. of Easter Beurre.									
Beurre d'Austrasie. D'45,438,'57,513,'69,790. E'54,372,'59,392. Syn. of Jaminette.									
Beurre d'Austrassie. F281. Syn. of Jaminette.									
Beurre dAutien. D'69,819. Syn. of Napoleon.									
Beurre d'Avalon. EFABC'00. Syn. of Avalon.									
Beurre d'Avoine. F278. Hort'68,73. D'69,681. AHortA'69,79. Syn. of Avoine.									
Beurre d'Avranches. D'69,805. Syn. of Louise.									
Beurre de Beauchamps. K'41 136. Syn. of Beauchamps.									
Beurre de Beaumont. FGAofO'72,13. Syn. of Beaumont.									
Beurre de Beaumont. D'45,364,'57,475,'69,762. E'54,351,'59,361. T'75,538,'85,553. Syn. of Vaet.									
Beurre de Bollwiller. E'54,390,'59,418. EFABC'00. Syn. of Bollwiller.									
Beurre de Bourgogne. D'69,760. Syn. of Flemish.									
Beurre de Brignais. D'57,470,'69,681. Cult'57,373. F277. E'59,376. CGenX,302. T'75,538,'85,553. B'83,366. NYC'90. Syn. of Brignais.									
Beurre de Caen. D'69,710. AHortA'71,70. Syn. of Brown.									
Beurre de Cambron. D'45,432,'57,503,'69,773. HovI,5. F280. Syn. of Glout Morceau.									
Beurre de Capiaumont. K'32,166,'41,140. GenF'33,196. Cult'39,66. D'45,357,'57,473,'69,682. T'75,261,'85,279. EFABC'00. Syn. of Capiaumont.									
Beurre de Cercle. D'69,687. Syn. of Cercle.									
Beurre de Cercle Practique de Rouen. MagofH'60,219. Syn. of Cercle.									
Beurre de Charneau. E'59,379. Syn. of Brabant.									
Beurre de Chaumontel. D'69,718. Syn. of Chaumontel.									
Beurre de Conick. D'69,684. Syn. of Koning.									
Beurre de Courtrai. EFABC'00. Syn. of Courtrai.									
Beurre de Deftinge. Pr212. D'69,760. Syn. of Flemish.									

Beurre d'Ecole. F287. Syn. of Ecole									
Beurre d'Elberg. D'57,469,'69,668. E'59,362. T'75,538,'85,553. Syn. of Dumas									
Beurre d'Enghein. AHortA'71,65. OH'71,48. Syn. of Beurre Colmar									
Beurre d'Enghien (of France). K'41,137. F278. D'69,678. Syn. of Beurre Colmar									
Beurre d'Estrapa. MagofH'51,473. MassH'51,175. Syn. of Estrapa									
Beurre d'Ete. F276. Syn. of Bergamote d'Ete									
Beurre d'Ete. D'69,863. Syn. of Franc Real (Sum.)									
Beurre Defais. F278. E'59,378. D'69,682. Syn. of Defais									
Beurre Defays. D'69,682. Syn. of Defais									
Beurre de Fevrier. MagofH'60,153. D'69,682. Syn. of Fevrier									
Beurre de Flanders. K'41,169. Syn. of Flandre									
Beurre de Flandre. D'45,427,'57,473,'69,696. E'54,350,'59,361. F277. Syn. of Rance									
Beurre de Fontenay. HovII,81. D'57,423,'69,690. F228,277. T'75,539,'85,553. Syn. of Gray Winter.									
Beurre de Fromentel. AJofHIX,251. Syn. of Ghelin									
Beurre Deftinghem. D'69,760. Syn. of Flemish									
Beurre de Gelle. GenF'37,278. D'69,686. Syn. of Diel									
Beurre de Ghelin. D'69,682. EFABC'00. CanExFR'03,421. Syn. of Ghelin									
Beurre de Gommery. F278. Syn. of Gommery									
Beurre de Hamptienne. F278. D'69,791. Syn. of Witte									
Beurre d'Hardenpont. Pr91. GenF'33,197. D'45,437,'57,503,'69,773. HovI,5. E'54,325,'59,339. F216. AgR'62,185. T'75,539,'85,553. Syn. of Glout Morceau.									
Beurre d'Hardenpont d'Automne. D'69,683. Syn. of Autumn Hardenpont									
Beurre d'Hardenpont (erroneously). K'32,188. Syn. of Aremberg									
Beurre d'Hardenpont de Cambron. D'69,773. Syn. of Glout Morceau									
Beurre d'Hardenpont Panache. EFABC'00									In experimental orchard at Agassiz, B. C.
Beurre d'Herl. H135		r	m	gy			g	l	Mr. Lyon considered this name an error.
Beurre d'Hiver. K'32,143. GenF'33,196,'37,278. D'45,433,'57,569,'69,718. E'54,359,'59,372. F279. T'75,539,'85,553. Syn. of Chaumontel.									
Beurre d'Hiver. D'69,751. Syn. of Easter Bergamot									
Beurre d'Hiver. D'69,690. Syn. of Gray Winter									
Beurre d'Hiver. D'69,696. Syn. of Rance									
Beurre d'Hiver Amboise. A'62,117. Syn. of Beurre Gambier									
Beurre d'Hiver de Bruxelles. Pr53. K'32,193,'41,160. GenF'33,198,'37,278. D'45,425,'57,428,'69,751. E'54,317,'59,331. F277. Syn. of Easter Beurre.									
Beurre d'Hiver Nouvelle. D'45,437. HovI,5. E'54,325,'59,339. AgR'62,185. Syn. of Glout Morceau.									
Beurre d'Hiver Nouveau. MagofH'57,258. Syn. of D'Hiver Nouveau									
Beurre d'Hyver. Pr94. Syn. of Chaumontel.									
Beurre d'Hyver Nouvelle espec. Pr53. Syn. of Easter Beurre									
Beurre d'Isambert le Bon. D'69,710. Syn. of Brown									
Beurre de Jalais. D'69,705. Syn. of Jalais									
Beurre de Johnge. MagofH'57,258. AofHIV,182. D'69,683. AHortA'69,79. EFABC'00. Syn. of Beurre Johnge.									
Beurre de Kachengheim. MagofH'49,389. Syn. of Kachengheim									
Beurre de Kent. D'69,773. Syn. of Glout Morceau									
Beurre de Kent. K'41,170. MagofH'42,250. Syn. of Kent									
Beurre de Koning. D'57,470,'69,684. E'59,364. T'75,539,'85,553. Syn. of Koning									
Beurre de Konink. E'59,364. Syn. of Koning									
Beurre de la Chapelle. D'69,705. Syn. of Chapelle									
Beurre de la Cour. AndN'95. EFABC'00. Syn. of Cour									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre Delannoy. D'57,468,'69,684. Syn. of Delannoy									
Beurre de la Pentecote. GenF'33,198. Cult'39,66. D'45,525,'57,428,'69,751. E'54,317,'59,331. F277. T'85,310. Syn. of Easter Beurre.									
Beurre del Assomption. AgR'75,381. Syn. of Assomption									
Beurre de l'Assomption. Hort'68,178. D'69,672. MassH'73,97. HMHS397. AofH'89,151. B'83,378. E&B'94. Syn. of Assomption.									
Beurre de Launay. F278. Syn. of Launay									
Beurre Delbecq. K'32,162,'41,137. MassH'44,61. Hort'49,456. D'69,684. Syn. of Delbecq.									
Beurre Delbecq. K'32,162,'41,137. MagofH'43,431. F277. D'69,684 Syn. of Delbecq.									
Beurre Delbert. D678. Syn. of Albret									
Beurre de Lesmire. MichH'73,143. Syn. of Lesmire									
Beurre Delfosse. MagofH'54,454. Hort'54,416. E'59,365. D'69,684. Syn. of Delfosse.									
Beurre Delfosse (Gregoire). MagofH'54,234. Syn. of Delfosse									
Beurre Del Giusti. AofH'92,276. Syn. of Giusti									
Beurre de Livonie. FGAofO'91,13. CanExFR'96,135. EFABC'00. Syn. of Livonie.									
Beurre de Louvain. AgR'54,297. F282. Syn. of Louvain									
Beurre Delpierre. Dap124. Syn. of Delpierre									
Beurre de Lucon. HovII,81. E'59,364. MagofH'60,216. D'69,690. EFABC'00. Syn. of Gray Winter.									
Beurre de Malines. D'45,450,'57,447,'69,884. HovI,15. B'51,311. E'54,346,'59,355 F205. AgR'62,190. T'75,539,'85,553. Syn. of Winter Nelis.									
Beurre de Mans. D'69,684. Syn. of Mons (Beurre)									
Beurre de Merode. D'57,433,'69,742. F279. Syn. of Boussock									
Beurre de Messode. E'54,334. AgR'62,182. Syn. of Boussock									
Beurre de Misode. F200. Syn. of Boussock									
Beurre de Moise. F278. Syn. of Moise									
Beurre de Mons. D'69,684. Syn. of Mons (Beurre)									
Beurre de Montgeron. MagofH'53,109,'55,273. D'57,468,'69,684. E'59,364. A'64,66. T'75,539,'85,553. Syn. of Montgeron.									
Beurre de Montgeron. F280. Syn. of Wurtemburg									
Beurre de Montigeron. MagofH'52,474. E'59,364. D'69,684. Syn. of Montgeron									
Beurre de Mortefontaine. HovII,89. F277. D'69,799. Syn. of Lefevre									
Beurre de Mortefontaine. D'57,566,'69,693. Syn. of LeFevre (Beurre)									
Beurre de Mortillet. EFABC'00. CanH'02,403. Syn. of Mortillet									
Beurre de Nantes. MagofH'54,454. D'57,457,'69,685. F277. E'59,363. A'62,66. T'75,539,'85,553. B'83,282. Syn. of Nantes.									
Beurre de Nivelles. MagofH'57,258. D'69,685. EFABC'00. Syn. of Nivelles									
Beurre de Noirchain. K'41,157. Cult'47,340. E'54,351. F277. D'69,696. Syn. of Rance.									

Beurre d'Or. GenF'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238,277. Syn. of Brown.
Beurre d'Ore. GarCal587. Syn. of Brown.
Beurre d'Orphelines. F230. Syn. of Aremberg.
Beurre de Paimpol. Hort'55,259. F278. A'69,88. AHortA'69,73. Syn. of Paimpol.
Beurre de Paques. D'45,425,'57,428,'69,751. E'54,317,'59,331. F277. AgR'62,180. T'75,539,'85,553. Syn. of Easter Beurre.
Beurre de Paques. Dap155. Syn. of Soulers.
Beurre de Paris. F280. D'69,758. Syn. of Jargonelle (Eng.)
Beurre de Payence. D'45,374,'57,508. F278. Syn. of Calebasse.
Beurre de Printemps. D'69,725. Syn. of Invalides.
Beurre de Quenast. D'57,468,'69,685. F277. T'75,539,'85,553. Syn. of Quenast.
Beurre de Rackenheim. D'69,662. Syn. of Apple.
Beurre de Rance. AofH'90,202. Syn. of Rance.
Beurre de Rans. D'45,427,'57,473,'69,696. Cole173. E'54,351,'59,361. H132. F277. T'75,539,'85,553. Syn. of Rance.
Beurre de Reine. E'54,350. F278. Syn. of Reine.
Beurre de Remme. D'69,766. Syn. of Fortunee.
Beurre de Rhin. D'69,696. Syn. of Rance.
Beurre de Rhine. E'54,350,'59,361. T'75,539,'85,553. Syn. of Rhine.
Beurre de Rhine. E'59,349. Syn. of Soldat.
Beurre de Rochoir. D'69,668. Syn. of Dumas.
Beurre de Rome. D'69,696. Syn. of Romain.
Beurre de Rouan. EFABC'00. Syn. of Rouan.
Beurre Derouineau. F278. MagofH'60,126. D'69,685. Syn. of Derouineau.
Beurre de Saint Arnaud. MagofH'60,219. D'69,685. Syn. of Arnaud.
Beurre de Saint Quentin. K'32,164. Syn. of Saint Quentin.
Beurre des Belges. D'69,859. Syn. of Stevens.
Beurre des Beguines. F278. Syn. of Beguines.
Beurre des Bois. F201. Syn. of Flemish.
Beurre Deschamps. K'32,188. GenF'37,278. HovI,1. D'69,680. Syn. of Aremberg.
Beurre de Semur. D'57,577,'69,661. Syn. of Angobert.
Beurre des Hautes. D'69,733. Syn. of Hardenpont (Aug.)
Beurre des Mouchouses. D'69, 685. Syn. of Mouchouses.
Beurre des Orphelines. K'32,188,'41,156. D'45,423,'57,462,'69,680. HovI,1. E'54,314,'59,366. AgR'65 188. F277. Syn. of Aremberg.
Beurre de Soulers. D'69,706. Syn. of Soulers.
Beurre de Spoelberg. D'69,877. Syn. of Spoelberch.
Beurre de Tongres. OH'87,95. Syn. of Tongres.
Beurre de Treveuren. F238. Syn. of Brown.
Beurre de Trois Tours. F210. Syn. of Diel.
Beurre de Wael. A'56,37. AgR'56,330. D'69,695. Syn. of Beurre Navez.
Beurre de Waterloo. Hort'51,113. B'51,314,'83,380. E'54,353. H188. D'69,747. MichH'74,28. Syn. of Brabant.
Beurre de Westerloo. Cult'47,340. D'69,742. Syn. of Boussock.
Beurre de Wetteren. MagofH'54,459. D'57,462,'69 685. E'59,364. EFABC'00. Syn. of Wetteren.
Beurre de Yelle (of some). GenF'33,196. D'45,355. HovI,65. Syn. of Bosc.
Beurre de Yelle. K'32,189,'41,156. GenF'33,196. D'45,360,'57,429,'69,686. HovI,77. F277. Syn. of Diel.
Beurre de Zurick. F278. Syn. of Zurick.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre Diel. K'32,189,'41,156. GenF'33,196,'37,278. M'38,90,'44,79,'47,82. Cult'39,66,'42,166,'44,37. D'45,360,'57,424,'69,686. Cole169. B'51,303,'83,367. Wg67. HovI,77. AgR'50,95,'53,291,'54,250. E'54,313,'59,327. A'62,66. T'75,259,'85,277. WnI,321,II,336,III,258. Syn. of Diel.									
Beurre Diel Panache. EFABC'00. Syn. of Diel Panache									
Beurre Dilly. Dap155. EFABC'00. Syn. of Delannoy									
Beurre Doie (of the French). K'32,135. Syn. of Brown									
Beurre dore. DomEncIV,182. K'32,162,'41,121. Syn. of Gilded									
Beurre Dore de Bilboa. D'69,773. Syn. of Bilboa									
Beurre Doree. Pr49. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238,277. Syn. of Brown.									
Beurre Doree. C191. Pr43. K'41,121. H190. Syn. of White Doyenne									
Beurre Doyenne roux. Pr46. Syn. of Gray Doyenne									
Beurre Drapiez. D'57,445,'69,871. F222,277,283. Syn. of Urbaniste									
Beurre Dremont. MassH'51,189. MagofH'52,39. Syn. of Dremont									
Beurre Dubison. EFABC'00. Syn. of Dubison									
Beurre du Buisson. EFABC'00. Syn. of Buisson									
Beurre du Cercle. AJofHV,248,VI,377. D'69,687. Syn. of Cercle									
Beurre du Coloma. D'69,678. Syn. of Coloma									
Beurre Duhaume. MagofH'52,299,'54,87. WHRII,559. MassH'53,21. D'57,470,'69,687. F277. E'59,362,365. IllH'69,156. T'75,539,'85,554. Syn. of Duhaume.									
Beurre Dumon. D'69,687. Syn. of Dumont									
Beurre Dumont. D'69,687. EFABC'00. Syn. of Dumont									
Beurre Dumortier. D'69,687. CanExFR'01,546. Syn. of Dumortier									
Beurre Duquesne. K'32,162. MagofH'43,130. Syn. of Duquesne									
Beurre Durand. D'69,688. B'83,378. Syn. of Durand									
Beurre du Roi. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238,277. Syn. of Brown.									
Beurre du Roi. K'32,163,'41,154. MagofH'44,131. HovII,21. AgR'62,188. Syn. of Urbaniste.									
Beurre du Roi. GenF'33,196. Syn. of White Doyenne									
Beurre Duval. K'32,163,'41,137. GenF'33,196. Cult'39,66. MagofH'42,86,'48,62. D'45,363,'57,472,'69,688. B'51,313. E'54,390,'59,418. F278. T'75,259,'85,277. Syn. of Duval.									
Beurre Duvernay. D'69,736. Syn. of Devergnies									
Beurre Duvivier. D'69,688. Syn. of Duvivier									
Beurre Easter. Cult'39,66. B'51,309,'83,374. E'54,317,'59,331. AgR'56,339,347,'62,180. F277. H127. T'75,292,'85,310. Syn. of Easter Beurre.									
Beurre Emperor Alexander. MagofH'54,234. Syn. of Emperor Alexander									
Beurre Epine. Pr54. K'32,190. GenF'33,198,'37,278. D'45,427,'57,473,'69,696. E'54,351,'59,361. F277. Syn. of Rance.									
Beurre Esperin. E'59,366. Syn. of Esperin									

Beurre Extra. D'69,784. Syn. of Hollande.									
Beurre Figue. H133. Syn. of Figue.									
Beurre Flon. D'69,688. Syn. of Flon.									
Beurre Fortunee. K'41,157. D'45,436. E'54,395,'59,421. Syn. of Fortunee.									
Beurre Fougiere. D'57,466,'69,688. F277. E'59,361. T'75,539,'85,554. EFABC'00. Syn. of Fougiere.									
Beurre Froidard. D'69,760. Syn. of Flemish.									
Beurre Fromentel. AJofH'67,231. AHortA'68,79. D'69,682. Syn. of Ghelin.									
Beurre Gambier. A'62,117. EFABC'00. Syn. Beurre d'Hiver Amboise									May possibly be Passe Colmar.
Beurre Gerards. D'69,772. Syn. of Gilogil.									
Beurre Gendron. D'69,688. Syn. of Gendron.									
Beurre Gens. MagofH'51,472. D'57,469,'69,689. F278. E'59,362. T'75,539,'85,551. Syn. of Gens.									
Beurre Giffard. MagofH'48,111. B'51,313,'83,363. Hort'54,61. AgR'54,243,249,'56,344. D'57,461,'69,689. F235. E'59,325. A'62,66. HH'69,158,'84,67. T'75,250,'85,268. Syn. of Giffard.									
Beurre Giffart. B'51,313. MagofH'51,399,'52,151,433. Syn. of Giffard.									
Beurre Gifford. E'54,351,'59,325. H131. CGenXVII,30. Fi52. WnI,324,II,334. Syn. of Giffard.									
Beurre Gilles. EFABC'00. Syn. of Gilles.									
Beurre Golden of Bilboa. A'62,66. B'83,378. Syn. of Bilboa.									
Beurre Goubalt. MagofH'50,340. Hort'53,506,'55,64. A'62,66. MoH'63,45. D'69,690. T'85,301. Syn. of Goubalt.									
Beurre Goubault. B'51,313. AgR'54,251,'56,345. D'57,468. F278. H130. T'75,283,'85,301. EFABC'00. Syn. of Goubalt.									
Beurre Gris. C188. Pr49. K'32,135,'41,120. GenF'33,196. D'45,357,'57,471,'69,710. E'54,350,'59,360. H132. F277. T'75,539,'85,554. Syn. of Brown.									
Beurre Gris d'Automne. D'69,710. Syn. of Brown.									
Beurre Gris de Bilboa. D'69,773. Syn. of Bilboa.									
Beurre Gris d'Ete. D'69,886. FGAofO'92,97. Syn. of Yat.									
Beurre Gris d'Hiver. HovII,81. D'57,423,'69,690. F228. E'59,364. AHortA'68,79. T'75,291,'85,309. EFABC'00. Syn. of Gray Winter.									
Beurre Gris d'Hiver de Lucon. D'57,423. F278. Syn. of Gray Winter.									
Beurre Gris d'Hiver Nouveau. MagofH'48,110. E'54,317. H154. MichH'74,30. B'83,375. WnI,327,II,337. Syn. of Easter Beurre.									
Beurre Gris d'Hiver Nouveau. K'41,157. D'45,426,'57,423,'69,690. NAPC'49,38. Wg67. HovII,81. B'51,309,'83,375. H134. AgR'56,367. E'59,364. T'85,309. Cult'65,76. Syn. of Gray Winter.									
Beurre Gris de Lucon. F228,277. D'69,690. T'75,539,'85,554. Syn. of Gray Winter.									
Beurre Gris de Portugal. D'69,773. Syn. of Bilboa.									
Beurre Gris Superieur. HovII,81. D'57,423,'69,690. F228,277. E'59,364. Syn. of Gray Winter.									
Beurre Haffner. Hort'61,220. D'69,691. Syn. of Haffner.									
Beurre Haffner (Liegil). MagofH'54,234. Syn. of Haffner.									
Beurre Haggerston. MagofH'42,57. D'45,333,'57,520,'69,802. E'54,390,'59,396. AgR'56,345. F281. Hort'58,121. A'62,70. T'75,539,'85,554. Syn. of Limon.									
Beurre Hamecher. D'57,470,'69,691. E'59,362. T'75,539,'85,554. Syn. of Hamecher.									
Beurre Hamecker. F278. Syn. of Hamecher.									
Beurre Hammecher. MagofH'52,299,WHRII,559. Syn. of Hamecher.									
Beurre Hardenpont. K'41,161. Syn. of Glout Morceau.									
Beurre Hardi. AgR'58,396. Syn. of Hardy.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre Hardy. B'51,314,'83,367. AgR'56,330,'75,378. D'57,466,'69,691. F238. E'59, 366. A'62,66. AHortA'70,77. Hort'70,355. T'75,270,'85,288. WnI,325,II,335,III, 258. Syn. of Hardy.									
Beurre Hatif. D'69,863. Syn. of Rose (Sum.)									
Beurre Incomparable. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F210, 277. AgR'62,181. Syn. of Diel.									
Beurre Isambert. F277. Syn. of Brown									
Beurre Jacob. CanExFR'98,399. Syn. of Jacob									
Beurre Jalais. D'69,692	Fr	robop	l	yrb	dmgj	sp		m	Originated by M. Jacques Jalais at Nantes in 1848.
Beurre Jean Van Geert. D'69,692. EFABC'00. Syn. of Van Geert									
Beurre Johnge. L. Syn. Beurre de Johnge	Belg	obop	ml	yrru	jm	sp	g-vg	l	Originated by M. Gambier.
Beurre Judes. MagofH'52,152,'54,85. MassH'53,20. Hort'54,126. D'57,466. F227. E'59,364. Syn. of Angleterre.									
Beurre Kennes. MagofH'53,541,'57,164. MassH'53,21. A'56,146,'62,66. AgR56,331. Hort'57,216,'59,37. D'57,460,'69,692. F277. CGenIII,11. E'59,365. T'75,259,'85, 277. Syn. of Kennes.									
Beurre Kenrick. MagofH'42,64,'47,437. D'45,362,'57,566,'69,692. Hort'49,456. A'54,237. E'54,390,'59,418. H130. F278. T'75,539,'85,554. Syn. of Kenrick.									
Beurre Kirtland. AgR'56,346. Syn. of Kirtland									
Beurre Knight. F278. Syn. of Quinn									
Beurre Knox. MagofH'52,419. D'57,563,'69,657. F276. Syn of Amadotte									
Beurre Knox. Pr195. K'32,163,'41,137. Cult'39,66. D'45,360,'57,566,'69,692. NAPC'49,38. E'54,390,'59,418. A'54,237. H130. F278. T'75,539,'85,554. Syn. of Knox.									
Beurre Koninck. MassH'45,88. D'69,684. Syn. of Koning									
Beurre Koning. A'62,110. Syn. of Koning									
Beurre Kossuth. MagofH'52,295. E'54,351,'59,361. D'57,464,'69,692. H135. F278. T'75,539,'85,554. Syn. of Kossuth.									
Beurre Lade. AJofHVII,54. GarM'72,27. Dap122. EFABC'00. CanExFR'03, 421. Syn. of Lade.									
Beurre Ladec. MagofH'42,431. Syn. of Lade									
Beurre Langelier. MagofH'50,338. Hort'51,112. Cult'51,210. B'51,314. HovII,3. E'54,312,'59,332. AgR'54,297,'56,351. D'57,457,'69,693. H130. F233. A'62,66. IllH'63,23. T'75,287,'85,305. Syn. of Langelier.									
Beurre Lasalle. D'69,733. Syn. of Hardenpont (Ang.)									
Beurre Lebrun. EFABC'00. Syn. of Lebrun									
Beurre Le Fevre. D'57,566,'69,693. Syn. of Lefevre (Beurre)									
Beurre le Fevre. Cult'47,340. HovII,89. F277. D'69,799. Syn. of Lefevre									
Beurre Lenzen. EFABC'00. Syn. of Lenzen									
Beurre Leon le Clerc. WHRII,559. D'57,471,'69,673. F277 E'59,36,365. T'75, 539,'85,554. Syn. of Le Clerc (Beurre).									

Beurre Leon Rey. D'69,801. EFABC'00. Syn. of Rey									
Beurre Liebart. D'69,802. Syn. of Liebart									
Beurre Loisel. F278. Syn. of Loisel									
Beurre Lombard. D'69,773. Syn. of Glout Morceau									
Beurre Luc. F194. Syn. of Lucrative									
Beurre Lucrative. HovI,41. F276. D'69,762. Syn. of Lucrative									
Beurre Luizet. D'69,693. EFABC'00. Syn. of Luizet									
Beurre Magnifique. D'69,742. Syn. of Boussock									
Beurre Magnifique. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F277. AgR'62,181. T'85,210. Syn. of Diel.									
Beurre Martin. CGenIX,159			vl						Published in Country Gentleman, vol 9, p. 159.
Beurre Mauxion. MagofH'57,259. D'57,472,'69,693. MassH'58,74. B'83,378. T'75,539,'85,554. Syn. of Mauxion.									
Beurre Melon. F210. Syn. of Diel									
Beurre Melonde de Kops. F210. Syn. of Diel									
Beurre Menand. D'69,693. AJofHVIII,229. Syn. of Menaud									
Beurre Menaud. D'69,693. Syn. of Menaud									
Beurre Merod. MagofH'53,109. Syn. of Boussock									
Beurre Merod. MagofH'53,40. Syn. of Merod									
Beurre Milan d'Hiver. F278. Syn. of Winter Milan									
Beurre Millet. MagofH'51,550. Hort'54,311,'56,35. E'54,353,'59,363. H135. F278. CGenXXV,94. FGAofO'75,61. EFABC'00. Syn. of Millet (Ang.).									
Beurre Millet (of Angers). MagofH'52,166. D'57,470,'69,694. E'59,362. T'75,539,'85,554. Syn. of Millet (Ang.).									
Beurre Millet (of Guernsey). F277. Syn. of Guernsey									
Beurre Moire. K'41,138. B'51,313,'83,379. E'54,352,'59,328. D'57,459,'69,694. F278. H132. T'75,259,'85,277. Syn. of Moire.									
Beurre Moiret. D'69,694. Syn. of Moire									
Beurre Mollett's Guernsey. E'54,351,'59,361. H126. T'75,539,'85,554. Syn. of Guernsey.									
Beurre Mondelle. F278. D'69,695. Syn. of Mondelle									
Beurre Montica. EFABC'00. Syn. of Montica									
Beurre Mortefontaine. K'41,139. NAPC'49,38. Syn. of Mortefontaine									
Beurre Mortillet. EFABC'00. Syn. of Mortillet									
Beurre Nantais. MagofH'53,23,'54,454. MassH'53,18. Hort'54,76. E'54,353,'59,363. AgR'56,405. D'57,457,'69,685. H130. F277. Cult'58,12. CGenIII,11, X,398. T'75,539,'85,553. Syn. of Nantes.									
Beurre Napoleon. FGAofO'91,12. Syn. of Blumenback									
Beurre Napoleon. F281. HH'67,208. Syn. of Napoleon									
Beurre Naver. E'59,365. Syn. of Naver									
Beurre Navez. MagofH'51,472,'52,39,299,'54,83. MassH'51,189,'53,18. WHRII,554. Hort'53,66,'54,79. D'57,460,'69,695. T'75,271,'85,289. Syn. of Navez.									
Beurre Neill. MagofH'42,60. E'54,398. T'85,281. Syn. of Niell									
Beurre Neil. E'59,330. Syn. of Anjou									
Beurre Niell. D'45,401,'57,526,'69,821. Syn. of Niell									
Beurre Noirchain. E'54,351,'59,361. Syn. of Rance									
Beurre Noir Graine. Pr151. K'32,180. Syn. of Noir Grain									
Beurre Noisette. F278. D'69,695. T'75,540,'85,554. Syn. of Navez									
Beurre of Bolwiller. MagofH'50,295. A'54,237. Syn. of Bollwiller									
Beurre of Duhamel. K'32,135. Syn. of Brown									
Beurre Oken. D'69,822. Syn. of Oken									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Beurre or Bonne Louise d'Araudore. D'45,397,'57,520,'69,805. E'54,330,'59,345. F281. AgR'62,185. Syn. of Louise.									
Beurre Orphelins (of Deschamps). GenF'37,278. Syn. of Aremberg									
Beurre Oswego. AgR'53,282. H133. A'62,66. Syn. of Oswego									
Beurre ou Bonne Louise Auraudore. HovI,39. E'54,330. Syn. of Louise									
Beurre Oudinot. MagofH'53,516. E'54,379,'59,402. D'57,467,'69,660. F278. T'75,540,'85,554. EFABC'00. Syn. of Andrews.									
Beurre Paimpol. MagofH'60,127. D'69,695. Syn. of Paimpol									
Beurre Parthenay. D'69,671. Syn. of Parthenay									
Beurre Pater Nostre. K'41,137. Syn. of Pater Noster									
Beurre Payen. F278. Syn. of Payen									
Beurre Perault. AJofHV,241. D'69,748. Syn. of Bordeaux									
Beurre Perpetual. GaH'92,49. AndH'95. LaB22. EFABC'00. Syn. of Perpetual									
Beurre Perrault. EFABC'00. Syn. of Perrault									
Beurre Philippe Delfosse. D'57,469,'69,684. F278. T'75,540,'85,554. Syn. of Delfosse.									
Beurre Picquery. K'41,157. D'45,365,'57,445,'69,871. B'51,308,'83,374. HovII,21. E'54,342,'59,352. AgR'56,388,'62,188. H134. F222. T'85,285. Syn. of Urbaniste.									
Beurre Piquery. Cult'47,340. T'75,540,'85,554. IaH'79,325. Syn. of Urbaniste									
Beurre Plat. K'32,135. D'45,375,'57,571. E'54,393,'59,420. F279. Syn. of Crassane.									
Beurre Plat or Flat Butter Pear. Pr75. Syn. of Crassane									
Beurre Pointelle de Roux. D'69,695. Syn. of Pointelle									
Beurre Preble. MagofH'42,60. D'45,363,'57,472,'69,695. WHRI,65. E'54,351,'59,361. H125,130. F272. T'75,271,'85,289. Syn. of Preble.									
Beurre Precoce. F278. AHortA'69,77. D'69,695. Syn. of Precoce									
Beurre Prince de Schwarzenberg. D'69,796. Syn. of Kopertscher									
Beurre Quetier. EFABC'00. Syn. of Quetier									
Beurre Quitelet. AgR'54,243. F278. D'69,727. Syn. of Lamy									
Beurre Rance. Pr54. K'32,190,'41,158. GenF'33,198,'37,278. Cult'39,66. D'45,427,'57,473,'69,696. MagofH'51,551,'52,162. B'51,309. E'54,351,'59,361. F277. T'75,540,'85,554. EFABC'00. Syn. of Rance.									
Beurre Ranse. D'69,696. Syn. of Rance									
Beurre Ranze. Hort'49,409. Wg67. Syn. of Rance									
Beurre Rhine. H127. Syn. of Rhine									
Beurre Richelieu. MagofH'54,234. D'57,460,'69,696. F277. E'59,365. T'75,540,'85,554. Syn. of Richelieu.									
Beurre Robert. A'75,68. Dap155. Syn. of Comice									
Beurre Robert. D'69,696. Syn. of Robert. [May be Comice]									
Beurre Robin. D'57,490,'69,746. F279. E'59,378. T'75,540,'85,554. Syn. of Robin.									
Beurre Rochechourt. F276. D'69,668. Syn. of Dumas									
Beurre Romain. D'45,368,'57,474. F278. E'59,366. Syn. of Montigny									
Beurre Romain. Pr55. K'32,163,'41,138. D'45,364,'57,566,'69,696. E'54,390,'59,418. H132. F279. T'75,540,'85,544. CanExFR'05,430. Syn. of Romain									

Beurre Romaine. M'44,91,'47,93. FGAofO'92,109. CanH'94,292. Syn. of Princess.									
Beurre Rome Ganyard. EFABC'00. Syn. of Ganyard									
Beurre Rom Ganjard. AndN'95. Syn. of Ganyard									
Beurre Ronde. F276. Syn. of Bergamote d'Ete									
Beurre Rouge. Pr49. K'32,135,'41,120. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238. T'75,540,'85,584. Syn. of Brown.									
Beurre Rouge (incorrectly of some). GenF'33,196. D'45,387,'57,432,'69,745. F279. Syn. of Gray Doyenne.									
Beurre Rouge d'Anjou. D'69,697. Syn. of Red Anjou									
Beurre Rouge Tardif D'69,782. Syn. of Henri Van Mons									
Beurre Roupe. D'45,425,'57,428,'69,751. E'54.312,'59,331. F277. AgR'62,180. Syn. of Easter Beurre.									
Beurre Rousse. D'69,710. Syn. of Brown									
Beurre Roux. D'69,710. Syn. of Brown									
Beurre Royale. K'32,189,'41,156. GenF'33,196,'37,278. Cult'44,37'47,340. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F210. AgR'62,181. T'75,540,'85,554. Syn. of Diel.									
Beurre St. Amour. D'69,760. Syn. of Flemish									
Beurre Saint Helier. F281. D'69,790. Syn. of Jaminette									
Beurre Saint Louis. F278. D'69,668. Syn. of Dumas									
Beurre St. Nicholas. MagofH'51,498. B'51,314. Hort'53,305. E'54,364,'59,331. AgR'59,356,'63,125. D'57,493,'69,749. F229. A'62,68. OH'63,14. FGAofO'75,60. T'75,540,'85,555. Syn. of Orleans.									
Beurre St. Quentin. K'41,168. Syn. of Quentin									
Beurre Samoyeau. A'73,76. Hort'74,148. FGAofO'74,14. T'75,540,'85,555. Syn. of Samoyeau.									
Beurre Sapelier. A'64,69,101. Syn. of Sapelier									
Beurre Scringe. A'75,68. Dap155. Syn. of Saumur									
Beurre Scheidweiler. AgR'56,331. D'57,469,'69,697. F277. T'75,540,'85,555. Syn. of Scheidweiler.									
Beurre Seatin. MagofH'40,45. Syn. of Beurre Seutin									
Beurre Seringe. F278. Hort'61,220. D'69,777. Syn. of Hamon									
Beurre Seutin. MagofH'50,295,'53,108. A'54,237. E'54,390,'59,418. D'57,566,'69,697. F278. T'75,540,'85,555. Syns. Beurre Seatin, Beurre Sutin.		ovp	m	gru				1	Perhaps distinct from Seutin.
Beurre Siculle. D'45,413,'57,436,'69,746. HovI,17. F240. E'54,313,'59,378. AgR'65,190. T'75,540,'85,555. Syn. of Sieulle.									
Beurre Six. MagofH'54,455. Hort'54,416. D'57,467,'69,697. F277. E'59,365. T'75,540,'85,555. FGAofO'92,97. CanExFR'00,461. Syn. of Six.									
Beurre Slatzsh. CanExFR'96,135. Syn. of Slutsk									
Beurre Slutsk. FGAofO'92,97. Syn. of Slutsk									
Beurre Slutzsk. FGAofO'91,13. Syn. of Slutsk									
Beurre Sophia. CGenXXV,94. T'75,540,'85,555. Syn. of Sophia									
Beurre Soulange. MagofH'53,541. MassH'53,17. Hort'54,81. CGenIII,11. D'57,468,'69,697. E'59,365. F277. T'75,260,'85,278. Syn. of Soulange.									
Beurre Soule. D'57,491,'69,747. Syn. of Angouleme									
Beurre Spae. D'69,697. CanExFR'04,179. Syn. of Spae									
Beurre Spence. Pr135. K'32,164,'41,138. GenF'33,198. D'45,365,'57,466,'69,697, MagofH'46,144. Cult'48,309. E'59,365. H134. F277. AJofHIX,117. T'75,540,'85,555. Syn. of Spence.									
Beurre Spence (erroneously). HovI,51. E'54,324,'59,337. D'57,438,'69,760. F201. Syn. of Flemish.									
Beurre Spence (of some collections). GenF'33,196. Syn. of Capiaumont									

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Beurre Sprin. D'57,498. Syn. of Esperine									
Beurre Sprin. MassH'50,159. E'54,354. H128. D'69,656. Syn. of Mon Dieu									
Beurre Stappaerts. MagofH'55,150. Syn. of Stappaerts									
Beurre Sterckmans. AgR'56,330. E'59,366. Syn. of Hardy									
Beurre Sterckmans. HovII,43. AgR'54,245. D'57,458. Syn. of Sterkmans									
Beurre Sterkman. F238. Syn. of Hardy									
Beurre Sterkmans. MagofH'41,472,'52,486. HovI,43. Hort'53,29. E'54,354. F277. D'69,698. T'75,260,'85,278. Syn. of Sterkmans.									
Beurre Stoeppert. Hort'63,161. Syn. of Stoeppert									
Beurre Suddall. EFABC'00. Syn. of Suddall									
Beurre Suis d'Hiver Nouveau. A'58,184. Syn. of Suis d'Hiver									
Beurre Suisse. E'54,350,'59,361. H133. Syn. of Suisse									
Beurre Superfin. MagofH'51,159. WHRIV,449. AgR'51,245,'56,330. D'57,465,'69,698. Hort'55,88. H127. F209. A'62,66. AHortA'68,79. T'75,271,'85,289. B'83,367. WnI,333,II,342. Syn. of Superfin.									
Beurre Superfine. MagofH'50,190. B'51,314. E'54,353,'59,363. AgR'63,122. Hort'73,168. Syn. of Superfin.									
Beurre Sutin. MagofH'40,76. Syn. of Beurre Seutin									
Beurre Tacon. K'41,170. MagofH'42,250. Syn. of Tacon									
Beurre Tanne. MagofH'42,431. Syn. of Tanne									
Beurre Thouin. MagofH'38,394. Cult'47,340,'58,322. MassH'48,98. Syn of Winter Nelis.									
Beurre Thoury. H132. Syn. of Thoury									
Beurre Tuerlinckx. MagofH'52,299. WHRII,559. D'57,553,'69,868. Syn. of Tuerlinckx.									
Beurre Ulmer. EFABC'00. Syn. of Ulmer									
Beurre Vaet. H135. Syn. of Vaet									
Beurre Van de Putte. F278. Syn. of Van de Putte									
Beurre Van Driessche. GarM'72,22. D'69,699. EFABC'00. Syn. of Driessche									
Beurre Van Marum. MagofH'37,51. M'38,76,'44,65. D'45,365,'69,873. Cole163. E'54,353,'59,363. AgR'54,215. WHRIV,162. H134. T'75,540,'85,555. Syn. of Van Marum.									
Beurre Van Mons. GenF'33,198. Cult'39,66. K'41,138. D'45,364,'69,664. MagofH'52,493. Hort'54,160,'66,42. E'54,390. A'54,237. Syn. of Mello.									
Beurre Van Mons. E'59,352. Syn. of Surpasse Virgalieu									
Beurre Vert. Pr49. K'32,135. GenF'33,196. D'45,357,'57,471,'69,710. E'54,350,'59,360. F277. Syn. of Brown.									
Beurre Vert. D'69,686. Syn. of Diel									
Beurre Verte de Livoine. FGAofO'92,97. Syn. of Verte de Livone									
Beurre Vital. EFABC'00. Syn. of Vital									
Beurre Von Kratish. EFABC'00. Syn. of Kratish									
Beurre Wetteren. MagofH'52,299. WHRII,559. Hort54,419. F278. Syn. of Wetteren.									

Beurre Whitzumb. MassH'45,88,'47,69. Syn. of Witzhumb									
Beurre Winter. MagofH'52,299. WHRH,559. D'57,467. F277. E'59,362	Eng	p	m	g	bm			l	Raised by Thomas Rivers, of England.
Beurre Witzcomb. MassH'44,60. Syn. of Witzhumb									
126 *Beurre Witzhumb.* K'32,190,'41,158. MassH'48,98. Hort'49,456. Syn. of Witzhumb.									
Beurre Woronson. A'60,158. T'75,540,'85,555. Syn. of Woronson									
Beurre Woronzon. GarM'71,214. A'71,55. Syn. of Woronson									
Beurre Woronzow. MagofH'54,234. AHortA'70,68. Syn. of Woronson									
Beurrare. K'32,132. Syn. of Summer Bergamot									
Beuzard. D'69,778. Syn. of Hampden									
Beverly. R. Syn. Beverly Hasle									Published in Magazine of Horticulture, 1839, p. 37.
Beverly Hasle. MagofH'39,37. Syn. of Beverly									
Beymont. D'57,474,'69,696. F277. T'75,271,'85,289,'97,467. Syns. Beurre Beymont, Beurre Bieumont, Bieumont.		obtp	m	gru	mg	sp		l	Thought to be a seedling of Rance.
Beymont. Hort'59,294. Syn. of Beaumont									
Beymont. F277. D'69,696. Syn. of Rance									
Bezi Blanc. Cole154. E'54,391,'59,418	Eur	oblp	l	yrru			g	me	
Bezi Caen. L. Syn. Bezi de Caen	Fr	p	m	gybr	gmj	sv	vg	l	
Bezi Chaumontelle Tres Gros. Pr53. GenF'33,198,'37,278. K'41,160. D'45,425,'57,428,'69,751. F277. AgR'62,180. Syn. of Easter Beurre.									
Bezi d'Airy. K'32,134,'41,123. Syn. of Heri									
Bezi de Caen. Cult'47,340. Hort'67,44. AHortA'68,79. D'69,699. Syn. of Bezi Caen.									
Bezi de Caissoy. C207. Pr125. H136. D'69,700. Syn. of Caissoy									
Bezi de Caissoy d'Ete. D'69,700. T'85,555. Syn. of Caissoy d'Ete									
Bezi de Caissoy d'Hiver. T'75,540,'85,555. Syn. of Caissoy									
Bezi de Cassoy. K'32,152,'41,122. Syn. of Caissoy									
Bezi de Chasseri. Pr124. Syn. of Echasserie									
Bezi de Chasserie. D'45,435. E'54,367,'59,381. Syn. of Echasserie									
Bezi de Chassery. K'32,144. Syn. of Echasserie									
Bezi de Chaumontelle. C200. Pr94. K'32,143,'41,123. GenF'33,196. D'45,433,'57,569,'69,718. E54,359,'59,372. F279. H136. T'75,540,'85,555. Syn. of Chaumontel.									
Bezi d'Echassie. E'54,367,'59,381. Syn. of Echasserie									
Bezi d'Echassey. D'45,435,'57,572,'69,753. F280. Syn. of Echasserie									
Bezi d'Esperen. MassH'51,189,'53,21. E'54,355. AgR'54,243. MagofH'57,158,167. T'85,555.	For	t	l		m		vg	l	Described by Rivers.
Bezi d'Heri. GenF'33,197. Cult'39,66. K'41,123. D'45,428,'57,565,'69,700. E'54,391,'59,418. F278. T'75,540,'85,555. Syn. of Heri.									
Bezi d'Hery. Pr36. K'32,134. Syn. of Heri									
Bezi de Hery. K'32,152. D'69, 700. Syn. of Heri									
Bezi de la Motte. Pr79. K'32,134,'41,121. GenF'33,198. Cult'39,66. D'45,368,'57,475,'69,700. MagofH'47,342. Wg67. E'54,355,'59,367. AgR'54,251. H136. F278. A'62,66. T'75,540,'85,555. IaH'77,387,'78,264. FGAofO'83,222. IllH'96,186. Syn. of La Motte.									
Bezi de la Pierre. D'69,701. Syn. of Pierre									
Bezi de Louvaine. Pr205. K'32,164,'41,138. Syn. of Louvain									
Bezi de Montigny. Pr48. K'32,134,'41,121. GenF'37,277. D'45,368,'57,474,'69,701 Cole163. Wg67. B'51,303. MagofH'48,198. E'54,355,'59,366. H136. F278. Hort'75,245. T'75,540,'85,555. Syn. of Montigny.									
Bezi de Naples. E'54,355,'59,367	For	ovo	m	ygru	dbj	s	vg	me	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bezi de Naples. H136. Syn. of Naples									
Bezi de Quassoi d' Ete. PaFS'71,68. Syn. of Caissoy d'Ete									
Bezi de Spoelberch. E'54,385,'59,412. Syn. of Spoelberch									
Bezi des Veterans. MagofH'51,472. D'57,566,'69,701. F228. EFABC'00. Syn of Veterans.									
Bezi de Veterans. E'59,405. T'75,540,'85,555. Syn. of Veterans									
Bezi Esperen. F278. D'69,701. Syns. Besi Esperen, Bezy d'Esperen	Belg.	robtp	l	yru	j	v	g	m	Raised by Maj. P. J. Esperen.
Bezi Goubault. F278. Hort'61,317. D'69,701	Fr.	robo	m	yru	dgm		g	vl	Originated in 1845.
Bezi l' Echasserie. D'57,572,'69,753. Syn. of Echasserie									
Bezi Mai. Cult'60,312. CGenXVI,174. D'69,702. Syn. of Mai									
Bezi Precoce. D'69,695. Syn. of Precoce									
Bezi Quessoi d' Ete. MagofH'57,259. Syn. of Quessoi									
Bezi Reinwardt. MagofH'55,146. Syn. of Reinwardt									
Bezi Royal. GenF'33,197. D'45,428,'57,565. E'54,391,'59,418. F278. Syn of Heri									
Bezi Saint Vaast. F278. Syn. of Vaast									
Bezi Sanspareil. B'51,313. E'54,354,'59,367. OH'66,58. IllH'69,156	For.	robtp	s	gyru	mj	p	vg-b	vl	Apparently distinct from Bezy Sanspareil of Downing.
Bezi Tardif. MassH'51,189. Syn. of Bezi Tardy									
Bezi Tardy. F278. Syn. Bezi Tardif	For.								In Field's list of undescribed varieties.
Bezi Vaet. GenF'33,88. Cult'39,66. K'41,158. D'45,428,'57,475,'69,702. MagofH-'50,295. E'54,390,'59,361. F278. T'75,540,'85,555. Syn. of Vaet.									
Bezi Veterans. MagofH'46,146. Syn. of Veterans									
Bezy de Caissoy. Pr125. K'32,143. Syn. of Caissoy									
Bezy de Chassery. Pr124. Syn. of Echasserie									
Bezy de Chaumontel. Pr94. GenF'37,278. Syn. of Chaumontel									
Bezy d'Esperen. MagofH'48,209. D'57,476,'69,701. T'75,540,'85,555. Syn. of Bezi Esperen.									
Bezy d'Esperen (erroneously). D'57,455. E'59,367. Syn. of D'Esperen									
Bezy de la Motte. Pr79. Syn. of La Motte									
Bezy de Louvain. K'41,138. D'57,486,'69,734. F279. Syn. of Louvain									
Bezy de Quessoy. Pr125. D'69,700. Syn. of Caissoy									
Bezy de Saint Vaast. K'32,190. Syn. of Vaet									
Bezy de St. Wast. Hort'59,294. Syn. of Beaumont									
Bezy Garnier. MagofH'52,259. D'57,476. F278. E'59,367. T'75,541,'85,555. Syn. of Garnier.									
Bezy Quessoy d' Ete. D'57,476. F278. E'59,367. T'75,541,'85,555. Syn. of Caissoy									
Bezy Sanspareil. D'57,476,'69,702. F278. H136. MichH'74,30. T'75,541,'85,555. Syn. of Sanspareil.									
Bezy Vaet. Pr198. K'32,190,'41,158. Syn. of Vaet									
Bezy Waat. Pr198. Syn. of Vaet									
Bezy Waet. Hort'59,294. Syn. of Beaumont									

Bicknell. MagofH'39,37. MassH'45,90. Syn. Quince									Exhibited at meeting of Massachusetts Horticulture Society in 1845 by J. P. Cushing.
Biemont. MagofH'51,550. F277. D'69,673. Syn. of Beauchamps									
Bien Armudi. K'32,134,'41,121. Syn. of La Motte									
Bieumont. T'97,695. Syn. of Beymont									
Bigarrade. Pr42. Syn. of Orange Striped									
Bigarride. D'69,863. Syn. of Rose (Sum.)									
Bihorel. L. Syn. Fondante de Bihorel	Fr		m		m		g	e	Barry says, "one of the best early pears."
Bijou. PJB'94. IllH'96,209. T'97,695			m	yr				e	Briefly described by Thomas, 1897, p. 695.
Bilboa. T'85,293,'97,695. Bul6. Syns. Beurre Dore de Bilboa, Beurre Golden of Bilboa, Beurre Gris de Bilboa, Beurre Gris de Portugal, Driver, Golden Beurre, Golden Beurre of Bilboa, Golden Bilboa, Hooper's Bilboa.	Spain	obop	m	yru	bmg	v	vg	me	Imported from Spain by Mr. Hooper in 1827.
Bill Campbell. JVL'93. Syn. of Campbell									
Binche. L. Syn. Josephine de Binche	Belg.	rp	m	ybm	j	sp		ml	Raised by M. Binche from seed of Malines (Jos.).
Bingo Master. Cult'50,45									Not described.
Binet. R. Syn. Francis Binot									In experimental orchard at Agassiz, B. C.
Birket. IllH'86,180. Syn. of Burkett									
Birkett. IndH'75,44. IaH'82,175,'94,169. IllH'85,17. TVM'94,'96,'99. SBro. WNYH'99,91. BBL. Syn. of Burkett									
Birkett (possibly). AHM264. Syn. of Sudduth									
Birkitt. IllH'79,71. Syn. of Burkett									
Bis Curtet. D'69,727. Syn. of Lamy									
Bishop's Thumb. Pr199. K'32,164,'41,138. GenF'33,198,'37,277. Cult'39,66. D'45,369,'57,566,'69,702. Cole167. E'54,591,'59,418. A'54,237. H137. F278. T'75,541,'85,555,'97,695. Syn. of Thumb.									
Bivort (Alex.). L. Syn. Alexandre Bivort	Fr	obtp	m	yru	gj	s	g	l	Originated by Maj. P. J. Esperen in 1848.
Bivort (Art.). L. Syn. Arthur Bivort	Belg.	oblp	ml	gyr	dmj	v	g	m	Originated by Dr. John Van Mons.
Bivort (Chas.). L. Syn. Charles Bivort	Belg.	obt	m	yru	cojm	s	g	m	
Bivort (Clem.). L. Syn. Clement Bivort	Belg.	robo	m	yr	bgmj	sp		ml	Described by the "Societe Van Mons."
Bezi d'Echassery. F280. Syn. of Echasserie									
Black Achan. IndH'90,158. Syn. of Achan									
Black Beurre. D'69,875. Syn. of Verulam									
Black Hawk. MassH'43,5. MagofH'45,427,'49,43	Conn						p		Originated by Gov. Edwards, of New Haven, Conn.
Black Pear (of Worcester). K'32,151,'41,128. Syn. of Catillac									
Black Pear (of Worcester). Pr117. Syn. of French Pound									
Black Pear (of Worcester). M'38,96,'44,86,'47,86. D'45,429,'57,567,'69,702. Cole174. E'54,318,'59,333. F278. HMHS15. Syn. of Worcester.									
Black Seeded. Pr151. Syn. of Noir Grain									
Black Seeded Beurre. Pr151. Syn. of Noir Grain									
Black Vermilion. WHRI,65. Syn. of Sheldon									
Black Worcester. D'45,429,'57,567,'69,702. MagofH'48,411,'63,161. Wg68. E'51,318,'59,333. H157. F278. A'62,66. IllH'69,155,'96,209. T'75,287,'85,305,'97,478. B'83,379. Syn. of Worcester.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Blakeny. R. Syn. Blakeny Red									In experimental orchard at Agassiz, B. C.
Blakeny Red. EFABC'00. Syn. of Blakeny									
Blanc. T'97,695. Syn. of White Doyenne									
Blanche. D'69,858. Syn. of Spanish									
Blanche Fleur. Cult'48,369. F278. Syn. of Little Blanquet									
Blanche Sannier. R. Syn. Mademoiselle Blanche Sannier									Being tested in Ontario, Canada.
Blanchet. R. Syn. Claude Blanchet									In experimental orchard at Agassiz, B. C.
Blanc Per Ne. WHRII,559	Eng.?		l		m			vl	From Rivers' Catalogue.
Blanc-per-ne. MagoffH'52,299,'54,138. D'57,575,'69,800. Hort'63,251. Syn. of Laval.									
Bland. Hort'56,184. Hof. D'69,855. Syn. of Sheldon									
Blanquet. R. Syns. Blanquet a longqueue, Long-Stalked Blanquet		p	s	q		s		e	
Blanquet. Pr15. K'32,128. EFABC'00. Syn. of Blanquette									
Blanquet Alexis. F278. Syn. of Alexis									
Blanquet a longqueue. K'32,129,'41,118. Cult'50,45. Syn. of Blanquet									
Blanquet a longue Queue. Pr16. K'41,118. A'54,237. Syn. of Blanquet (Long Stem).									
Blanquet Anastere. D'69,703. Syn. of Anastere									
Blanquet Anasterque. D'69,703. Syn. of Anastere									
Blanquet d'Austrasia. D'69,703. Syn. of Anastere									
Blanquet d'Florence. D'69,775. Syn. of Blanquette									
Blanquet de Saintonge. F278. Syn. of Saintonge									
Blanquet Le Gros. F278. Syn. of Blanquette									
Blanquet (Long Stem). L. Syns. Blanquet a longue queue, Blanquette a longue queue, Blanquette a longue queuen, Gillette Longue, Long Stalk blanquet, Long Stalked Blanket, Long Stalked Blanquet, Long Tailed Blanquette, Skinless, Sucree blanche, Suchrin blanc d'Ete.		r	s	gy	brd	sv	g	e	A very old and probably valueless variety.
Blanquet Le Petit. F278. Syn. of Little Blanquet									
Blanquet Petit. Pr17. D'69,802. Syn. of Little Blanquet									
Blanquet Precoce. F278	For								In Field's list of undescribed varieties.
Blanquet St.Onge. HAJ'88,74. Syn. of Onge									
Blanquette. Pr15. Syns. Bagpipe of Anjou, Blanquet, Blanquet de Florence, Blanquet le Gros, Great Blanket, Great Blanquette, Gros Blanquet, Grosse Blanquet, Grosse Blanquette, Grosse Roi Louis, Musette d'Anjou, Roi Louis.	Fr	ovp	s	yb	mj	s	g	me	An old French sort of doubtful value.
Blanquette. K'32,128. Syn. of Little Blanquet									
Blanquette a longue queue. Pr16. MagoffH'43,130,'50,295. D'69,804. Syn. of Blanquet (Long Stem).									
Blanquette a longue queuen. K'41,118. D'69,804. Syn. of Blanquet (Long Stem)									
Bleecker. L. Syns. Bleecker's Meadow, Feaster, Frankford, Heidelberg, Large Seckel, Meadow Feaster, Meadow Pear, Spice, Spice Butter.	Pa	r	s	yb	j	p	g	m	Found in a meadow near Philadelphia, Pa.

Bleecker's Meadow. Pr215. MagofH'37,70,'48,339,'53,566. M'38,88'44,76,'47,81. K'41,138. D45,355,'56,567,'69,703. NAPC'49,15. Cole167. B'51,302. Cult'53,120. AgR'54,272. A'54,84,239,'99,15. E'54,391,'59,368. F272. T'75,541,'85,555,'97,695. Syn. of Bleecker.									
Blessed. DomEncIV,187. Syns. Belle Fertile, Poire Benite	Fr.		s				vg	me	Described by Dr. Mease in Domestic Encyclopedia, 1804.
Blight Proof. BBL. FDNCo.'01									Not described.
Block. R. Syn. Block's Superb	Cal.	rov	m	gyru	m			m	Originated by A. Block, of Santa, Clara, Cal.
Block's Acme. WnI,331,II,341,III,259. Syn. of Acme									
Block's Superb. WnI,331,II,341. Syn. of Block									
Blodget. Pr216	Me.	p	m		mj	v		me	Raised by D. Blodget, late of Camden, Me.
Blood. Wg68. Syn. of Sanguinole									
Bloodgood. M'38,65,'44,19,'47,58. K'41,131. MagofH'43,366. D'45,332'57,428,'69,703. Cole153. AgR'50,94. B'51,299,'83,368. Wg68. G83. E'54,356,'59,333. F196. Hort '65,53,'71,284,366. T'75,254,'85,272,'97,454. WnI,324. Bl228. Syn. Early Beurre.	N. Y.?	obot	m	yru	bm	sp	vg	e	Introduced in 1835 by James Bloodgood, of New York.
Bloodgood Pear (of New York). K'32,156. GenF'37,277. Syn. of Julienne									
Bloody. Pr26. K'41,119. D'69,851. Syn. of Sanguinole									
Blossomless pear, or pear without blossoms. Pr27 Syn. of Figue									
Blumenbach. FGAofO'91,12. Syns. Beurre Blumenbach, Beurre Napoleon, Blumenbach's Butter.									This may prove to be Soldat.
Blumenbach. D'69, 856. Syn. of Soldat									
Blumenbach's Butter Pear. FGAofO'91,12. Syn. of Blumenbach									
Boal. R. Syn. Dr. Boal's	Ill.?		m				g		Claimed to have originated in Peoria, Ill.
B. O. de la Cour. D'69,811. Syn. of Marechal									
Bodin. MassH'47,69. Syn. Bodin's Seedling									Exhibited by Robert Manning at meeting of Massachusetts Horticultural Society, 1847, p. 69.
Bodin's Seedling. MagofH'40,173,'41,386. Syn. of Bodine									
Bogmiln. R. Syn. Golden Knap Bogmiln									Published by Magazine of Horticulture, 1843, p. 131.
Bohemia. L. Syns. Citronbirne, Citronbirne Bomesche Grosse punctirte, Citron of Bohemia, Great Citron of Bohemia, Green Citron of Bohemia.		obl	s	y	jg	p	p	me	
Bohlen. GenF'40,156									Not described.
Boisbunel. L. CanExFR'01,536. Syns. Beurre Boisbunel, Beurre Boisfunel, Boisbunel's Flask.	Fr.	obop	m	gyru	gjm	sp	g	me	Origin with L. M. Boisbunel in 1835 at Rouen, France.
Boisbunel's Flask. EFABC'00. Syn. of Boisbunel									
Bois Napoleon. MassH'48,98. E278. D'69,819. Syn. of Napoleon									
Boisnard. R. Syn. Doyenne Boisnard									In experimental orchard at Agassiz, B. C.
Boisselot. R. Syns. Doyenne Boisselot, Fortune Boisselot, Fortunee Boisselot									Not described.
Bolivar. F283. A'62,70. D'69,835. Syn. of Pound									
Bolivar d'Hiver. D'69,835. Syn. of Pound									
Bollwiller. D'69,671. T'97,695. Syns. Beurre Bollwiller, Beurre de Bollwiller, Beurre of Bolwiller.		obtp	l	gyru	djm	s	g	vl	A culinary pear.
Bologna. R. Syn. Lewis of Bologna	Belg.		m	y			g	l	Originated by Dr. John Van Mons, of Louvain.
Bonaparte. Cult'47,340. F281. D'69,819. Syn. of Napoleon									
Bonchamp. R. Syn. General de Bonchamp									Published in Horticulturist, 1875, p. 2.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bon Chretien. Pr59. Syn. of Bon Chretien (Sum.)									
Bon Chretien. D'69,884. Syn. of Bon Chretien (Win.)									
Bon Chretien Antoine Lorimer. WNYH'05,140									Exhibited at meeting of Western New York Horticultural Society, 1905, p. 140.
Bon Chretien Barnett. D'69,666. Syn. of Bartlett									
Bon Chretien Bruxelles. A'54,238									Rejected by Congress of Fruit Growers in 1849.
Bon Chretien d'Amiens Chartreuse. F279. D'69,716. Syn. of Catillac									
Bon Chretien D'Auch. Pr94. K'32,143,'41,128. Syn. of Auch									
Bon Chretien d'Auch. Cult.'47,340. D'69,884. Syn. of Bon Chretien (Win.)									
Bon Chretien d'Angoisse. F278. Syn. of Bon Chretien (Win.)									
Bon Chretien d'Angoisse Variegated. F278. Syn. of Angoisse Var									
Bon Chretien d'Automne. D'69,858. Syn. of Spanish									
Bon Chretien de Bruxelles. K'41,168. Cult'47,340. D'69,704. Syn. of Bon Chretien Fondante.									
Bon Chretien de Chaumontel. D'69,718. Syn. of Chaumontel									
Bon Chretien de Constantinople. D'69,884. Syn. of Bon Chretien (Win.)									
Bon Chretien d'Espagne. C209. Pr'93. K'32,140,'41,122. D'45,430,'57,567,'69,858. E'54,391,'59,418. H138. F278. EFABC'00. Syn. of Spanish.									
Bon Chretien d'Esperen. MagofH'50,295									Rejected by Congress of Fruit Growers, 1849.
Bon Chretien d'Ete. DomEncIV,190. C187. Pr59,61. GenF'37,277. K'32,132,41,120. D'45,346,'57,583,'69,863. MagofH'49,440. A'54,238. E'54,399,'59,424. H193. F282. T'85,571. EFABC'00. Syn. of Bon Chretien (Sum.).									
Bon Chretien d'Ete Jaune. D'69,863. Syn. of Bon Chretien (Sum.)									
Bon Chretien d'Ete Musque. K'41,119. MagofH'43,130. D'69,704. Syn. of Bon Chretien Fondante.									
Bon Chretien d'Ete Musque. Pr61. Syn. of Bon Chretien (Sum.)									
Bon Chretien d'Hiver. C203. Pr92. K'32,150,'41,125. GenF'37,228. A'54,238. F278. H137. D'69,884. EFABC'00. Syn. of Bon Chretien (Win.).									
Bon Chretien de Kalonga. FGAofO'91,11. Syn. of Kalonga									
Bon Chretien de Nouvelle. K'41,161. Syn. of Bon Chretien (Fl.)									
Bon Chretien de Rance. F277. Syn. of Rance									
Bon Chretien de Rans. D'69,696. Syn. of Rance									
Bon Chretien de Tours. D'69,884. Syn. of Bon Chretien (Win.)									
Bon Chretien de Turc. F228. Syn. of Charlotte									
Bon Chretien de Vernois. K'32,143. Syn. of Bon Chretien (Win.)									
Bon Chretien de Vernon. D'69,884. Syn. of Bon Chretien (Win.)									
Bon Chretien Dore. D'69,819. Syn. of Napoleon									

Bon Chretien dore d'Espagne. D'69,858. Syn. of Spanish									
Bon Chretien (Fl.). L. Syns Bon Chretien de Nouvelle, Bon Chretien Flemish, Bon Chretien Nouvelle Espece, Bon Chretien Turc, Bon Chretien Vernois, Flemish Bon Chretien, Poire Turque, Turkish Bon Chretien, Turkish Pear.	Fl.?	obop	m	yru	coj			vl	Strictly a culinary variety.
Bon Chretien Flemish. B'51,311. E'54,391. T'85,555. Syn. of Bon Chretien (Fl.)									
Bon Chretien Flemish. F278. Syn. of Charlotte									
Bon Chretien Fondante. Pr199. K'32,168,'41,139. GenF'33,198. M'38,82,'44,69,'47,72. Cult'39,66. D'45,270,'57,477,'69,704. Cole163. MagofH'48,59. AgR'54,243. E'54,356,'59,333. F278. H137. T'75,271,'85,289,'97,467. Syns. Bon Chretien de Bruxelles, Bon Chretien d'Ete Musque, Bon Chretien Fondante Musque, Bon Chretien Musque, Bon Chretien Musque Fondante, Bugiarda, Melting Bon Chretien, Musk Summer Bon Chretien, Petit Musque, Pioulice.	Fl.	robo	ml	gru	gjdm	vp	vg	m	
Bon Chretien Fondante Musque. D'69,704. Syn. of Bon Chretien Fondante									
Bon Chretien Fred Baudry. WNYH'93,44,'95,25. E&B'94. EFABC'00. Syn. of Baudry.									
Bon Chretien Gratioly. D'69,863. Syn. of Bon Chretien (Sum.)									
Bon Chretien Jaune d'Automne. D'69,858. Syn. of Spanish									
Bon Chretien Joseph Lamarque. D'69,704. Syn. of Lamarque									
Bon Chretien Musque. K'32,139. Syn. of Bon Chretien Fondante									
Bon Chretien Musque. Pr61. Syn. of Bon Chretien (Sum.)									
Bon Chretien Musque Fondante. D'69,704. Syn. of Bon Chretien Fondante									
Bon Chretien Napoleon. K'41,143. Cult'47,340. F281. Syn. of Napoleon									
Bon Chretien No. 15. EFABC'00. [On trial by number at Agassiz, B. C.]									
Bon Chretien Nouvelle Espece. Pr206. K'32,163. GenF'37,278. Syn. of Bon Chretien (Fl.).									
Bon Chretien of Brussels. MagofH'50,295									Rejected by Congress of Fruit Growers, 1849.
Bon Chretien Panache. Pr94. K'41,128. Syn. of Auch									
Bon Chretien Panache. K'32,181,'41,152. Syn. of Striped Bon Chretien									
Bon Chretien Provost. IaH'79,325. Syn. of Provost									
Bon Chretien Sans pepins. Cult'47,340									Not described.
Bon Chretien Soblesky. FGAofO'92,97									Introduced from Lithuania.
Bon Chretien Spanish. Pr93. Cult'39,66. G84. B'51,311. A'54,238. F278. E'59,391. T'85,556. Syn. of Spanish.									
Bon Chretien Sprin. D'69,858. Syn. of Spanish									
Bon Chretien (Sum.). L. Syns. Apothecaries Pear, Beauclere, Bon Chretien, Bon Chretien d'Ete, Bon Chretien d'Ete Jaune, Bon Chretien d'Ete Musque, Bon Chretien Gratioly, Bon Chretien Musque, Canelle d'Ete, De Duchesse, Die Gute Christbirne, Die Sommer Christebirne, Governor Stuyvesant, Gracioli, Gracioli (of the French), Gracioli Rouge, Gratioli, Gratioli d'Ete, Gratioli di Roma, Gros Bon Chretien, Gros Bon Chretian Beauclere, Gros Bon Chretien d'Ete, Jargonelle, Large Sugar (of some), Musk Summer Bon Chretien, Reed's Seedling, Richards Beurre (of some), Safran d'Ete, Schelis, Sommer Apothekerbirne, Sommer Gute Christbirne Grosse, Sommer Gute Christenbirne, Stuyvesant, Summer Bon Chretien, Summer Christian, Summer Good Christian, William Powell.	Eur.	p	l	y	j	s	g	me	Cultivated throughout Europe as early as 1500.
Bon Chretien Turc. Pr206. Cult'39,66. K'41,161. D'45,130,'57,567,'69,761. E'54,391,'59,418. H157. IndH'90,158. Syn. of Bon Chretien (Fl.).									
Bon Chretien Vernois. K'41,161. D'69,761. Syn. of Bon Chretien (Fl.)									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Bon Chretien (Win.). L. Syns. A Tetine, Bon Chretien, Bon Chretien d'Angoisse, Bon Chretien d'Auch, Bon Chretien d'Hiver, Bon Chretien de Constantinople, Bon Chretien de Tours, Bon Chretien de Vernon, Crustemenie, De Chretien, De Dos, De Fesses, De Bon Crustemenien, De Saint Martin, Good Christian of Winter, Panchresta, Poire d'Angoise, Poire d'Apothecarie, Winter Bon Chretien, Winter Good Christian.	For.....	obtp	l	yb	coj	sp	......	vl	First cultivated and described in 1485.
Bonequia. A'54,238									Rejected by American Pomological Society, 1854, p. 238.
Bon d'Ezee. E'54,356,'59,368. Syn. of Ezee									
Bon Gustave. WHRII,559. D'57,477,'69,704. E'59,369	Belg....	p	m	gru	dbj	sp	......	l	Raised by Maj. Esperen.
Bon Gustave. MagofH'54,459. F278. T'75,541,'85,556,'97,695	Belg....	p	m	gru	bj	p	......	me	Apparently distinct.
Bonne Antoine. D'69,765	Fr?.....	obtp	vl	ygb	dgj	sp	b	m	From Leroy.
Bonneau. L. Syn. Joly de Bonneau		obo	ml	grub	gmj	sv	......	l	Described by Hogg as Joly de Bonneau.
Bonne Charlotte. D'57,477,'69,705. F278. E'59,369. T'75,541,'85,556,'97,695. Syn. of Charlotte.									
Bonne d'Avranches. D'69,805. Syn. of Louise									
Bonne d'Ezee. HovI,29. D'57,477,'69,705. F278. E'59,368. A'62,66. T'75,541,'85,556,'97,696. EFABC'00. Syn. of Ezee.									
Bonne de Jalais. D'69,705. Syn. of Jalais									
Bonne de Keinzheim. D'45,347,'57,584,'69,872. F283. Syn. of Vallee									
Bonne de la Chapelle. MagofH'54,458. Hort'54,419. D'69,705. Syn. of Chapelle									
Bonne de Longueval. D'57,477,'69,705. F274. Syn. of Ezee									
Bonne de Longueval. NWFG'55,40. D'57,520,'69,805. Syn. of Louise									
Bonne de Malines. Pr132. K'32,199,'41,167. GenF'33,197. Cult'39,66,'44,36. D'45,450,'57,447,'69,884. B'51,311,'83,337. HovI,15. E'54,346,'59,355. F205,283. T'75,541,'85,556,'97,696. Syn. of Winter Nelis.									
Bonne des Haies. HovI,29. E'54,356,'59,368. D'57,477,'69,705. H137. F278. Syn. of Ezee.									
Bonne de Soulers. Pr78. K'41,125. D'69,706. Syn. of Soulers									
Bonne des Zees. MagofH'49,107,'53,204. B'51,313. Syn. of Ezee									
Bonne de Zees. HovI,29. E'54,356. AgR'54,243,'56,365. D'57,477,'69,705. F278. Syn. of Ezee.									
Bonne du Puits Ansault. A'71,55,'81,30. OH'71,48. AHortA'71,67. Hort'72,102. AJofHVIII,229. Dap123. AgR'75,381. T'75,541,'85,556,'97,696. MichH'75,89,285. CanH'81,92. Syn. of Ansault.									
Bonne Emilie. F278. Syn. of Emilie									
Bonne-ente. GenF'33,196. K'41,121. D'45,378,'57,436,'69,880. HovII,85. F279. AgR'62,183. Syn. of White Doyenne.									
Bonnefond. R. Syn. Madame Bonnefond		obtp	ml	yru	j	s	......	ml	On trial at Agassiz, B. C.
Bonne Louise. DomEncIV,179. Pr97. Syn. of Louise Bonne									
Bonne Louise d'Araudore. D'69,805. Syn. of Louise									

Bonne Louise d'Avranches. F218. Syn. of Louise.									
Bonne Malinoise. MagofH'37,197'44,127. Syn. of Winter Nelis.									
Bonne Rouge. Pr74. GenF'33,196,'37,277. D'45,366,'57,457,'69,769. HovII,77. E'54,369,'59,384. F277. T'75,541,'85,556,'97,696. Syn. of Gansel Bergamot.									
Bonne Saplier. D'69,706. Syn. of Sophia.									
Bonners. A'69,51,'73,119. Syn. Pope.	Ga.					v	vg	m	Originated in Hancock County, Ga.
Bonner's Pope's Pear. D'69,751. Syn. of Easter Bergamot.									
Bonneserre. L. Syn. Bonneserre de Saint Denis.	Fr.	robo	ml	ygr	dmjg	svp		l	Originated by Andre Leroy, of Angers, France, in 1863.
Bonneserre de Saint Denis. D'69,705. EFABC'00. Syn. of Bonneserre.									
Bonne Sophia. AHortA'68,79. D'69,706. T'75,541,'85,556,'97,696. Syn. of Sophia.									
Bonne Therese. D'69,707. Syn. of Therese.									
Bonnisseme. D'69,760. Syn. of Figue.									
Bonnissima de la Sartha. D'69,760. Syn. of Figue.									
Bonny d'Eze. AN&OCo. Syn. of Brockworth Park.									
Bon Papa. D'69,875. Syn. of Vicar.									
Bon Parent. D'57,518,'69,798. F278,281. Syn. of Canas.									
Bordeaux. Bul6,8. EFABC'00. AHM235. Syns. Beurre Perault, Bourdeaux (Duchesse), Duchesse de Bordeaux, Duchesse de Bourdeaux.	Fr.	robtp	m	yru	j	s	g	vl	Originated near Angers, France, in 1850.
Bordenave. E'54,356,'59,343. Syn. of Lodge.									
Bordeniere. H138. Syn. of Lodge.									
Border. MagofH'36,37.								l	Shown December 12, 1836, by M. H. Ruggles at meeting of Massachusetts Horticultural Society.
Bordillon. L. Syn. Gregoire Bordillon.	Fr.		l					me	Briefly described by Barry, 1883, p. 381.
Borland. EFABC'00.									In experimental orchard at Agassiz, B. C.
Bosc. MichH'73,407,'88,119. MichSB27. S90. Bl228,237. CanH'93,355. T'97,458. Bul6,8. MoH'00,378. AHM235. Syns. Beurre Bosc, Beurre d'Apremont, Beurre de Yelle, Bosc's Flaschenbirne, Bosc's Haschenbirne, Bosc's Thascherbirne, Bosc's Beurre, Bosc's Early Gourdshaped Pear, Calebasse Bosc, Calebasse passe Bosc, Cannelle, Humboldt's Butterbirne, Marianne Nouvelle.	Belg.	ap	l	yru	mb	p	b	me	Raised by Dr. John Van Mons in 1807 and named in honor of M. Bosc.
Bosc's Flaschenbirne. D'45,358,'57,426,'69,674. HovI,65. E'54,315,'59,329. Syn. of Bosc.									
Bosch. GenF'33,196. K'41,135. D'45,386,'57,438,'69,760. HovI,51. E'54,321,'59,337. H122. F280. AgR'62,184. Syn. of Flemish.									
Bosc's Haschenbirne. F232. Syn. of Bosc.									
Boschier. Pr212. Syn. of Flemish.									
Bosch Nouvelle. HovI,51. E'54,324,'59,337. D'57,438,'69,760. H122. F280. Syn. of Flemish.									
Boschpeer. Pr212. D'45,386,'57,438,'69,760. Syn. of Flemish.									
Bosc Sire. D'45,386,'57,438,'69,760. HovI,51. E'54,324,'59,337. H122. F280. AgR'62,184. IllH'67,177. Syn. of Flemish.									
Bosc's Thascherbirne. F277. AgR'63,123. Syn. of Bosc.									
Bosc's Beurre. Hort'49,194. Syn. of Bosc.									
Bosc's Early Gourdshaped Pear. Hort'49,194. Syn. of Bosc.									
Bosnelle. MassH'51,189. Syn. Mons Bosnelle.		r	s	gbr	mj	s		m	Rots at core.
Bosquet. L. Syn. General Bosquet.	Fr.	ovp	m	g	dj		g	me	
Bosquet (Long). L. Syn. Longue du Bosquet.	Fr.	rp	m	yrru	dmj	p		me	Originated with Andre Leroy at Angers, France.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Boston. MagofH'51,464,'55,186. Hort'54,433,'58,166,473,482. A'54,156,'58,54. WHRIV,450. D'57,477,'69,833. E'59,404. T'75,541,'85,556,'97,696. Syn. of Pinneo.									
Boston Epargne. WPr10. E'54,370,'59,389. Syn. of Harvard.									
Boston Eparne. D'45,392,'57,506,'69,779. Syn. of Harvard									
Bouchamp. L. Syn. General de Bouchamp	Fr	robtp	m	gyru	djbm	svp		m	A chance seedling in the garden of M. Penneton.
Bouche Nouvelle. Pr133. K'32,172,'41,135. GenF'33,196. D'45,386. HovI,51. E'54,321. A'62,184. Syn. of Flemish.									
Bouchet. A'75,68. Syn. of Ananas									
Boucquia. MagofH'43,134. D'45,355,'57,567,'69,707. E'54,391,'59,419. Hort'55,193. H138. F278. T'75,541,'85,556,'97,696. Syn. Beurre Boucquia.	Fl	ovt	ml	y		a		m	
Boulogne. L. Syn. Auguste de Boulogne	For								In Field's list of undescribed varieties.
Boulogne. L. Syns. Louis of Bologna, Louise of Boulogne	Belg	robo	m	gy	jm	s	g-vg	m	
Bounty. L. Syn. Autumn Bounty	Amer							m	An American baking pear; an abundant bearer.
Bouquet. Cult'48,369. A'54,238									Reported from Mobile, Ala., by S. B. North.
Bourbon. R. Syn. Henri de Bourbon		p	m	gybr	t	s		ml	In experimental orchard at Agassiz, B. C.
Bordeaux (Duchesse). L. St. Syn. of Bordeaux									
Bourdon Musque. K'41,118. Syn. of Musk Orange									
Bourdon Musquee. Pr25. Syn. of Drone									
Bourdon or Humble bee pear. Pr25. Syn. of Drone									
Bourgemester. Cult'47,340. D'57,567,'69,707. F278. T'75,541,'85,556,'97,696. Syn. Bouvier Bourgemestre.		p	l	yru	dj	a		ml	
Bourgemester. K'32,65,'48,759. D'45,448. Cole168. HovI,47. Syn. of Vicar									
Bourgmestre Delfosse. D'69,684. Syn. of Delfosse									
Bourgmestre (of Boston). M'38,90,'44,83,'47,84. Syn. of Delfosse									
Bourgogne. L. Syn. Gustave de Bourgogne	For								Published by Field in undescribed list, p. 280.
Boussiere. L. Syn. Bergamotte Boussiere	Belg	robp		yg	jg		g	ml	Originated by Dr. John Van Mons.
Boussoch. D'69,742. Bl228,237. AHM236. Syn. of Boussock									
Boussock. T'75,271,'85,289,'97,467. MichSB27. MichB194. Bul6,8. Syns. Albertine, Beurre Boussock, Beurre de Merode, Beurre de Messoda, Beurre de Misode, Beurre de Westerloo, Beurre Magnifique, Beurre Merod, Boussoch, Boussouck, Delpiere, Double Philippe, Double Philips, Doyenne Boussock, Doyenne Boussock Nouvelle, Doyenne Boussouck Nouvelle, Doyenne Boussouck, Doyenne Broussack, Doyenne de Merode, New Boussouck, Nouvelle Boussouck, Plymouth, Providence.	Belg	obtp	l	yru	bjm	sp	vg	me	One of the best summer varieties.
Boussouck. E'54,318. H138. S92. AofH'91,291. Syn. of Boussock									
Bouteille. AgR'54,245. F278. E'59,363. D'69,873. Syn. of Van Marum									

Boutoc. MassH'71,39. EFABC'00.		oblp	ml	yrb	j			m	Exhibited by Robert Manning, 1871.
Bouvar. Pr106. K'32,147. Syn. of Merveille.									
Bouvier. D'69,798. Syn. of Canas.									
Bouvier Bourgemestre. MassH'53,20. MagofH'54,85. F278. E'59,369. D'69,707. Syn. of Bourgemester.									
Bowdoin. MagofH'37,48. Cult'47,340.									Not described.
Bowne. L. Syn. Bowne's Winter Russet.	N. Y.		l	gy			g	l	Originated at Flushing, Long Island, N. Y.
Bowne's Winter Russet. F272. Syn. of Bowne.									
Bon Parent. F278,281. D'69,798. Syn. of Canas.									
Boykin. R. Syn. Boykin's June.	Va.						vg	ve	Originated in Isle of Wight County, Va.
Boykin's June. A'73,108. Hort'75,275. FDNCo'01. Syn. of Boykin.									
Brabant. L. Syns. Belle Excellente, Beurre Charneuse, Beurre de Charneau, Beurre d'Waterloo, Charneau, Desire Van Mons, Duc de Brabant, Excellentissima, Fondante Charneuse, Fondante de Charneuse, Fondante de Cherneuse, Fondante des Charneuse, Fondante du Comice, General Warren, Jamin, Mervielle de Charneux, Miel d'Waterloo, Waterloo.	Belg.	oblp	l	gb	jbm	v	vg	m	
Brabant. T'97,696. Syn. of Soldat.									
Brabant (Duchesse Capenick). L. Syn. Duchesse de Brabant (Capenick).		r	m	yr	bmj	s		m	From Annals of Pomology.
Brabant (Duchesse Durieux). L. Syn. Duchesse de Brabant (Durieux).		tp	ml	gyru	clmj	svp	b	m	From Annals of Pomology.
Braconot. D'69,707. Syn. Poire Braconot d'Epinal.	Fr.		vl	gy	cj	s		m	Originated in 1840 or 1841.
Braddick. K'41,133. MagofH'43,130.									May be Marie Louise.
Braddick's Field Marshal. HovH,37. E'54,377,'59,398. Syn. of Marie Louise.									
Braddick's Field Standard. GenF'33,197. D'45,399,'57,522,'69,813. E'54,377. F281. Syn. of Marie Louise.									
Brande. L. Syns. Brande's, Bran de St. Germain, Brande's Saint Germain, Pyrus Brandesia, Saint Germain Brande's.	Eng?	ov	m	yg	mj	v	g	ml	Origin doubtful; probably with Dr. John Van Mons.
Brande's. F278. D'69,707. Syn. of Brande.									
Bran de St. Germain. D'69,707. Syn. of Brande.									
Brande's Saint Germain. D'45,448,'57,541,'69,707. MagofH'49,107,190,202. Hort'49,456. MassH'46,152. B'51,314. A'52,25,'54,139. E'54,356,'59,369. T'97,696. Syn. of Brande.									
Brandywine. Hort'48,166,'71,285. MagofH'49,106,'53,'65,450. Cole157. HovH,51. B'51,313,'83,393. Wg68. MassH'53,21. A'51,137,'62,66. E'54,313,'59,328. AgR-'54,244,'56,365. D'57,478,'69,707. F272. Hof. AJofH'67,42. T'75,251,'85,269,'97,452. S92. AHM236.	Pa.	p	m	gyru	jm	svp	g vg	me	Originated by Eli Harvey, Delaware County, Pa. in 1840.
Breaking pear of Brest. Pr65. Syn. of Brest.									
Bremer. L. Syns. Frederick Bremer, Frederika Bremer, Virgalieu (erroneously of some).	N. Y.	obtp	m	gy	mb	svp	g	m	First published in Magazine of Horticulture, 1850, p. 24.
Brest. L. Syns. Breaking pear of Brest, Brest Melting, Cassante de Brest, Chenau, Fondante de Brest, Inconnue Chenau, Inconnue Cheneau, Inconnue de Cheneau, Inconnue de Chesneau, Persick pear, Unknown Chenau.	For.								Possibly of little value.
Brest Melting. Pr65. Syn. of Brest.									
Bretagne. L. Syns. Grand Bretagne, Grande Bretagne dore, Grande Bretagne Doree d'Hiver, Grande Bretagne Doree Fondante, Great Britain.	Belg?	obop	ms	yrru	cogj	s	p	vl	
Bretagne le Cour. D'45,445,'57,537,'69,835. E'54,334,'59,346. Syn. of Pound.									
Breton. L. Syn. Le Breton.		obtp	m	yru	comj	sp	g-vg	l	Origin not known.
Bretonneau. T'97,696. EFABC'00. Syns. Beurre Bretouneau, Beurre Brettouneau, Brettouneau, Doctor Brettonneau.	Belg.	obop	l	gyrb	dm	svp	g	vl	Raised by Maj. Esperen; introduced in 1818.
Brettouneau. D'69,676. Syn. of Bretonneau.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Brewer. D'69,708.		obop	m	y	co	s	g	m	
Brewster. MassH'66,46.	Mass.								Originated at Brookline, Mass. Fruited in 1865.
Brialmont. F278. Hort'61,217. D'69,708. T'75,541,'85,556,'97,696. Syn. Brielmont.	Belg.	ov	m	gyru	jbm		vg	m	Described by Col. M. P. Wilder in Horticulturist, 1861, p. 217.
Briary Bush. MagofH'43,130. Syn. of Bush									
Brielmont. E'54,357,'59,369. H139. Syn. of Brialmont									
Briffaut. Hort'55,66. D'69,708. EFABC'00. Syn. Poire Briffaut	Fr.	oblp	l	gbr	jmg			e	Originated by Mr. Briffaut, of Sevres.
Brignais. MichH'93,38. T'97,696. Bul6. Syns. Beurre de Brignais, De Nonne, Des Nones, Des Nonnes, Nun's Pear, Poire des Nonnes.		robl	m	g	jm	pv	vg	me	Origin not certainly known.
Brilliant. K'32,172,'41,135. GenF'33,196. HovI,51. D'69,760. Syn. of Flemish									
Brilliante. Pr133. D'69,760. Syn. of Flemish									
Brindamour. D'69,709.	Fr.	rp	m	brg	dm			l	Originated in Vienne, France.
Bringewood. MagofH'43,124,'47,153. E'54,356,'59,369, H139. D'69,709	Eur.	p	m	ybru	gb		vg	m	First published by Magazine of Horticulture, 1843, p. 124.
Brissac. R. Syn. Duchesse de Brissac									In experimental orchard at Agassiz, B. C.
British. L. Bul6 Syn. British Queen	Eng.	obop	l	cru	dbm	s		m	Raised at Frogmore, England.
British Queen. A'69,53,'73,37. Hort'70,36. D'69,709. MassH'72,93,'75,119. AJofHVIII,228. FGAofO'74,12. Bul6. Syn. of British.									
British Russet. Pr22. Syns. Rousselet de Grande Bretagne, Roussette de Bretagne.		t			m	a		m	Described by Duhamel.
Broca's Bergamot. C188. Pr74. K'32,135,'41,127. GenF'33,196,'37,277. D'45,366,'57,457,'69,769. HovII,77. E'54,369,'59,384. H138. F277. T'97,696. Syn. of Gansel Bergamot.									
Brockholst. A'79,82. HMHS43. Syn. Brockholst Bergamot.									Probably Gansel Bergamot. See Transactions of American Pomological Society, 1879, p. 82.
Brockholst Bergamot. Th186. MagofH'51,482. Syn. of Brockholst.									
Brockworth. Dap123	Eng.	oblp	l	yrs	bjm	v			Raised by Mr. Laurence, of Brockworth Park.
Brockworth Park. GarM'71,57. AJofHIX,57. FGAofO'77,23. IaH'79,325. CanH'80,14,'81,37. HAJ'88,74. E&B'94. IllH'93,89. AN&OCo. EFABC'00. AHM237. Syn. Bonny d'Ezee.									Possibly identical with Ezee. See Canadian Horticulturist, 1880, p. 14.
Bromer. R. Syn. Charlotte de Bromer									Possibly same as DeBrower—Charlotte de Brower, of Downing.
Bronx. Hort'67,61. A'67,152. AJofHIV,50.	N. Y.	obop	m	gyru	jm	sp.	g-vg	me	Originated at Bronxville, N. Y. Introduced in 1850.
Bronze d'Enghiem. Dap124. Syn. of Enghiem									
Bronze Duchess. EFABC'00. Syn. Duchess d'Angouleme Bronze									In experimental orchard at Agassiz, B. C.

Brookline. MassH'66,45	Mass.								Originated at Brookline, Mass. Fruited in 1862.
Broom Park. K'32,167,'41,158. MagofH'43,125,'47,153,'55,46. D'45,428. B'51,314. E'54,391,'59,419. H139. F278. T'75,541,'85,556,'97,696. Syn. Sobden Court.	Eng	r	m	gyr	coj	s		vl	
Brougham. MagofH'43,125,'47,152. D'45,354,'57,568,'69,710. A'54,258. E'54,356,'59,420. H139. F278. T'75,541,'85,556,'97,696. Syns. Beurre Brougham, Brougham Hall.	Eng	robo		gyru	co	a		m	
Brougham Hall. K'32,165. Syn. of Brougham									
Brow. R. Syn. Brow's Seedling									Published in Magazine of Horticulture, 1840, p. 173, as Brow's Seedling.
Brow's Seedling. MagofH'40,173. Syn. of Brow									
Brown. L. Syns. Amboise or Ambroise, Amboise or L'Amboise, Badham's, Beurre, Beurre Brown, Beurre Butter, Beurre d'Ambleuse, Beurre d'Amboise Beurre d'Anjou (incorrectly), Beurre de Caen, Beurre d'Isambert, Beurre d'Or, Beurre de Treveuren, Beurre Doie (of the French), Beurre Doree, Beurre du Roi, Beurre Gris, Beurre Gris d'Automne, Beurre Isambert, Beurre of Duh, Beurre Rouge, Beurre Rousse, Beurre Roux, Beurre Vert, Brown Beurre, Brown Butter, [illegible], Gisambert, Golden Beurre, Gray Beurre, Gray Butter, Green Butter, Grey Beurre, Gris, Isambert, Isambert le Bon, Isambert of Normandy, La Beurre, Poire d'Amboise, Red Beurre, Red Butter, Rouge, True Golden Beurre.	Fr	oblobo	l	gyrub	bmj	sa	vg	m	Very highly esteemed, especially in France.
Brown Admiral. K'32,132. Syn. of Archduke									
Brown Admiral. Pr24. D'69,862. Syn. of Archduke									
Brown Beurre. GarCal587. C188. Th186. Pr19. K'32,135,'41,120. SW. GenF[illegible]. Cult'40,66. D'45,357,'57,471,'69,710. Wg68. Cole163. AgR'54,242,'56,366. NWFG'55,40. WHRII,474. CGenVI,31. T'75,271'85,289,'97,468. Syn. of Brown.									
Brown Butter. IllH'68,311									Reported from Madison County, Ill. Not described.
Brown Butter. F278. Syn. of Brown									
Brown Field. R. Syn. Brown's Field Pear									Cultivated by Silas Wharton, in 1824.
Brown's Field Pear. SW. IndH'72,110. Syn. of Brown Field									
Brown Orange. Pr82. K'32,138. Syn. of Messire									
Brown St. Germain. D'45,447,'57,548,'69,837. E'54,335,'59,348. Syn. of Germain (Prince).									
Brown Warden. MagofH'43,132. Syn. of Warden									
Bruce. TVM'89									May prove to be Alamo. See Munson's Catalogue for 1899.
Brugmansbirne. MagofH'38,395. MassH'47,69,'48,98. Syn. Brugman's Birne									Exhibited by Robert Manning, 1847.
Brugman's Birne. A'54,238. Syn. of Brugmansbirne									
Bruneau. L. Syns. Bergamotte Crassane de Bruneau, Bergamotte Crassane d'Hiver, Beurre Bruneau, Crassane Bruneau, Crassane d'Hiver, Crassane d'Hiver de Bruneau, De Saint Herblain, Winter Crassanne.		obtp	m	yb	j	va	g	ml	From Annals of Pomology.
Bruno de Bosco. MassH'45,88. MagofH'50,295. Cult'50,45. A'54,238.									Exhibited by Robert Manning, 1845.
Brussels. L. Syns. Belle de'Aout, Belle d'Aout or August, Belle de Brussels, Belle de Bruxelles, Belle of Brussels, Bellisime d'Automne, Beauty of Autumn, Beauty of Brussels, Beurre de Bruxelles, De Coq, Des Dames, Gros Muscadille, Muscadille, Muscat Rouge, Nouv-Cours Complet, Petit Certeau, Supreme, Vermilion, Vermillion d'Automne, Vermillion des Dames.		ap	ml	gy		s	p	me	
Brutte Bonne. K'32,152,'41,130									Not described.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Brutte Bonne (erroneously). Pr90. Syn. of Rousseline.									
B. S. Fox. A'77,42,'81,23,'95,68. Dap154. GarM'80,369. MoH'83,170. WnI,329,II, 339. JB'93. E&B'94. CNC'93. T'85,556,'97,467. Syn. of Fox.									
Buchanan. A'69,114	N. Y.?	obop	m	yru	comj	sv	g		From Isaac Buchanan, of New York.
Buchanan's New Spring Beurre. MagofH'43,130,'52,39. MassH'51,189. Syn. of Verulam.									
Buchanan's Spring Beurre. D'69,875. Syn. of Verulam									
Budd. FGAofO'93,146									Not described.
Buffalo. H151	For				cobj	sp			
Buffam. D'45,356,'57,429,'69,711. HovII,19. AgR'62,182. Syn. of Buffum.									
Buffum. K'32,166,'41,139. M'38,79,'44,66,'47,67. Cult'39,66. MagofH'44,300,'50,297. D'45,356,'57,429,'69,711. Cole164. HovII,19. B'51,302. Hort'53,551,'56,300,'70,104. AgR'53,282. Wg68. E54,318,'59,333. H140. F119. A'58,52,'62,66. T'75,271,'85, 289,'97,468. Syn. Buffam.	R. I	oblp	m	ygbru	bj	s	vg	me	Originated at Warren, R. I. Described by Kenrick in 1832, p. 166.
Bufo. L. Syns. Beauchamps, Belle de Brissac, Bergamot Buffo, Bergamotte Bufo, Bergamotte Cadette, Bergamotte Crapaud, Beurre Beauchamps, Beurre Cadet, Beurre Crapaud, Crapaud, Ogonet (incorrectly), Poire de Cadet.	Fr	robl	m	gyru	bj	sv	g	m	Old and probably obsolete.
Bugi. DomEncIV,183. Pr77. K'32,142. Syn. of Easter Bergamot									
Bugiarda. D'69,704. Syn. of Bon Chretien Fondante									
Bugiarde. Pr28. D'69,758. Syn. of Summer Thorn									
Bugiarde des Italiens. D'69,758. Syn. of Summer Thorn									
Buisson. R. Syn. Beurre du Buisson									On trial at Agassiz, B. C., experimental farm.
Bujaleuf. Pr87. K'32,149. GenF'33,197. D'45,450,'57,584,'69,877. E'54,400,'59,425. F283. Syn. of Virgouleuse.									
Burbige. FGAofO'74,68. Syn. of Burbridge. [Not sure as to spelling]									
Burbridge. FGAofO'71,25. A'75,97. Syn. Burbige	N. S. ?								Said to be a native of Port Williams.
Burgalue. Pr43. Syn. of White Doyenne									
Burgemeester. MagofH'40,76. Syn. of Burgomaster									
Burgermeester. GenF'33,198. MagofH'37,48. Cult'39,66. Syn. of Burgomaster									
Burgermeister. E'54,391,'59,418. Syn. of Burgomaster									
Burgermiester (incorrectly). HovI,47. AgR'62,189. Syn. of Vicar									
Burgomaster. MagofH'50,295. A'54,238. E'54,391,'59,418. Syns. Burgemeester, Burgermeester, Burgermeister.	Eur	p	m	yg				l	
Burgomaster. HMHS250. Syn. of Vicar									
Burgoyne. L. Syn. Gustave Burgoyne		oblp	l	gybru	jm	s	g	m	
Burkett. IllH'76,267,355,'80,144. IaH'76,355. Syns. Berkett, Birket, Birkett, Birkitt, Burkitt.	Ill								This and Sudduth may be the same. So said B. A. Mathews, of Iowa.

Burlingame. MagofH'49,344. E'54,391,'59,419. D'57,568,'69,711. T'75,541,'85,556,'97,696. Syn. Burlinghame.	Ohio	rob	sm	yr	co	s	p	me	Reported to Massachusetts Horticultural Society, 1830. Named for Mrs. Burlingame.
Burlinghame. K'41,132. B'51,314. E'54,391,'59,419. F272. Syn. of Burlingame									
Burlington. SW. IndH'72,110									Grown by Silas Wharton in 1821.
Burnett. K'41,139. D'45,370,'57,568,'69,712. E'54,391,'59,419. H140. F272. T'75,541,'85,556,'97,696.	Mass.	obtp	l	y	coj	s	g	m	Raised by Dr. J. Burnett, of Southboro, Mass.
Burnicq. L. T'97,696. Syn. Beurre Burnicq	Belg.	rp	m	yru	jm	va	g	m	Originated by Maj. Esperen. Fruited in 1846.
Burns. R. Syn. Burns' New Seedling	N. S.								Originated in Nova Scotia.
Burns' New Seedling. A'75,97. Syn. of Burns									
Burnt Cat. Pr89. Syn. of Chat Brusle									
Burrell. MagofH'40,135. MassH'51,188	Mass.								Exhibited at meeting of Massachusetts Horticultural Society, 1840. Named for originator.
Bush. R. Syn. Briary Bush									Published in Magazine of Horticulture, 1843, p. 130.
Bute Bonne d'Automne. D'69,863. Syn. of Rose (Sum.)									
Butler. IllH'84,82								l	Exhibited by E. T. Hollister, at meeting of Illinois Horticultural Society, 1884.
Butler's Harvest. D'69,767. Syn. of Jargonelle (Fr.)									
Butt. EFABC'00									In experimental orchard at Agassiz, B. C.
Butter. AgR'55,296. Syn. of Craig?									
Butter. Wg68. AgR'53,282. Syn. of White Doyenne									
Butterbirne. F224,279. AofH'91,296. Syn. of White Doyenne									
Butterbirne Weisse Livlandische. Gb. Syn. of White Livland									
Butter of Anjou. E'54,316. Syn. of Anjou									
Butter of Michigan. D'69,828. Syn. of Portugal									
Butter Pear. DomEncIV,180. AgR'61,142. Syn. of Gray Doyenne									
Butter Pear. Hort'53,458. D'57,508,'69,784. Syn. of Hosenschenck									
Butter Pear. E'54,322,'59,336. A'62,68. T'75,541,'85,556,'97,696. Syn. of White Doyenne.									
Butter Pear (of Pennsylvania). AgR'50,95. Syn. of White Doyenne									
Butter Pear (of Philadelphia). Cult'44,36. D'45,378,'57,436,'69,880. Cole 165. Hov-II,85. E'54,322. F224. B'83,369. T'85,556,300. Bl228. Syn. of White Doyenne.									
Button. A'75,101									Probably a worthless seedling.
Bymont. E'59,363. Syn. Beurre Bymont									Not described.
Byrne. R. Syn. Byrne Large Seedling									In experimental orchard at Agassiz, B. C.
Byrne Large Seedling. CanExFR'96,135. Syn. of Byrne									
Cabot. Pr214. M'38,81,'44,68,'47,72. MagofH'44,298. D'45,370,'57,478,'69,712. Hort'47,174. B'51,315. E'54,392,'59,419. H140. F272. AgR'58,423. A'62,66. T'75,272,'85,290,'97 468.	Mass.	rt	sm	gyru	bj	sa	g vg	me	Originated from seed of Brown at Salem, Mass.
Cacaudiere. L. Syn. Delices de la Cacaudiere	Fr.	obop	l	gyru	comj	s		e	Originated in France in 1846.
Cadet. K'32,153. Syns. Beauchamps, Bergamot Cadet, Burgamotte Cadet, Burgamotte Cadette, Bergamotte de Cadette, Beurre Beauchamps, Cadette, De Cadet, Milan de Bourdeaux, Poire de Cadet, Poire de Cadette.	Fr.	robl	m	yr	bj	s	g	m	
Cadet de Vaux. F278. Hort'68,304. D'69,712. IllH'69,156. Syn. of Vaux									
Cadette. K'41,121. Syn. of Cadet									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Cadette de Vaux. AHortA'69,79. Syn. of Vaux									
Cadillac. Pr109. D'45,432,'57,568,'69,716. E'54,392,'59,419. Syn. of Catillac									
Caen. L. Syns. Caen de France, Caen du France, Doyenne de Bruxelles (erroneously), Van Mons No. 51.	Eur.	ovobtp	m	yru	gjm	vp	vg	vl	Mr. Downing said, "Very promising."
Caen de France. MagofH'53,102,'55,188. D'57,478,'69,712. H140. F278. AHortA'68,73,'69,79. A'69,52. T'75,541,'85,556,'97,696. Syn. of Caen.									
Caen du France. E'54,357. AJofH'67,45,111,283. MassH'73,96. Syn. of Caen									
Caesar. Pr98. Syn. Poire de Cesar			l	gyr	b	p		l	Cultivated in Lorraine, France.
Cahokia. R. Syns. Cahokia Butter, Cahokia Seedling	Ill.?								Exhibited in 1847 at St. Louis, Mo.
Cahokia Butter. Hort'47,246. Syn. of Cahokia									
Cahokia Seedling. AJofH'67,361. Syn. of Cahokia									
Caillaurozat. D'69,863. Syn. of Rose (Sum.)									
Cailleau Rosat. Pr38. Syn. of Rose (Sum.)									
Caillorozar. D'69,863 Syn. of Rose (Sum.)									
Caillot Rosat. K'32,152,'41,130. Cult'39,66,'50,45. MagofH'50,295,'53,101. A'51,238. E'54,399,'59,424. F278. D'69,863. Syn. of Rose (Sum.).									
Caillot Rosat d'Ete. Pr38. D'45,345,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Rose (Sum.).									
Caissoy. L. Syns. Besi de Bretagne, Besi de Caissoy, Besi de Quassoy, Besi du Caissoy or Quessoy, Bezi de Caissoy, Bezi de Caissoy d'Hiver, Bezi de Cassoy, Bezy de Caissoy, Bezy de Quessoy, Bezy Quessoy d'Ete, D'Anjou (according to Lindley), De Quessoy, Nutmeg Pear, Pettit Beurre d'Hiver, Rouselet d'Anjou, Roussette d'Anjou, Small Winter Beurre, Small Winter Butter, Terreneuvaise, Wilding of Caissoy.	Fr.	rp	s	yrbru	db	sp	vg	vl	An old variety discovered in Caissoy.
Caissoy d'Ete. L. Syns. Bergamotte Quessoy d'Ete, Besi Quessoy d'Ete, Bezi de Caissoy d'Ete, Bezi de Quassoi d'Ete, Quessoy d'Ete.	Fr.	rp	s	ybru	db	sp	vg	me	Greatly resembles the preceding, but is medium early.
Caissoy d'Hiver. T 97,696		obo	ru	ru	b	v	vg	l	
Calabasse Oberdieck. GarM'72,27. EFABC'00. Syn. of Oberdieck									
Calebash. WPr12. Pr67. Syn. Calebasse				yru	b	sp			Possibly same as Calebasse.
Calebasse. Cult'39,66. MagofH'45,337. D'45,374,'57,568,'69,712. Wg68. E'54,392,'59,419. H140. F278. T'75,542,'85,556,'97,696. Syns. Beurre de Payence, Calebasse d'Hollande, Calebasse Double Extra, Calebasse Musk, Calebasse Musque.	Belg.	obl	m	yru	jco	s	g	me	Named from its likeness to a gourd or calebasse.
Calebasse. Pr67. Syn. of Calebash									
Calebasse. D'69,827. Syn. of Paradise									
Calebasse Abbe Fetel. EFABC'00. Syn. of Fetel									
Calebasse Bauchan. MagofH'55,146. Syn. of Bauchan									
Calebasse Boisbunel. MassH'71,41		ap	ml	yb	mj			l	Report of Fruit Committee, Massachusetts Horticultural Society, 1871, p. 41.
Calebasse Bosc. GenF'33,196. K'41,139. D'45,374,'57,426,'69,674. HovI,65. E'54,315,'59,329. F278. AgR'63,123. T'97,696. Syn. of Bosc.									
Calebasse Bosc. K'41,139. D'57,531,'69,827. F254,282. E'59,345. AgR'67,139. AJofHVI,145. T'75,542,'85,556. EFABC'00. Syn. of Paradise.									

Calabasse Carafon. D'69,873. Syn. of Van Marum									
Calabasse d'Albret. D'57,735,'69,678. Syn. of Albret									
Calabasse de Bavay. F287	For.								In Field's list of undescribed varieties.
Calabasse d'Etc. MagofH'52,440. E'54,358. D'57,479,'69,713. H141. F278. T'75,542,'85,556,'97,697. Syn. of Summer Calebasse.									
Calebasse d'Hiver. MagofH'48,111		t	ml		m			vl	Said to ripen in February and March.
Calebasse de Holland. D'69,873. Syn. of Van Marum									
Calebasse d'Hollande. D'45,374,'57,568,'69,712. E'54,392,'59,419. F278. Syn. of Calebasse.									
Calebasse de la Vigne. AgR'56,331. [Not identified as a named sort]									
Calebasse Delvigne. MagofH'54,136. E'54,392,'59,419. MassH'56,19. Hort'57,214. D'57,478,'69,783. F278. T'75,542,'85,556,'97,696. Syn. of Delvigne.									
Calebasse de Nerckmans. MagofH'52,150. D'69,873. Syn. of Van Marum									
Calebasse d'Octobre. OH'71,48. T'85,556,'97,697. Syn. of Calebasse (Oct.)									
Calebasse d'Octobre. AHortA'71,61. A'71,55. MassH'71,41. Hort'72,102. Dap-145. Syn. of October.									
Calebasse Double Extra. D'45,374,'57,568,'69,712. E'54,392,'59,419. F278. Syn. of Calebasse.									
Calebasse du Nord. D'69,873. Syn. of Van Marum									
Calebasse Fondante. K'32,166,'41,140	Belg.	oblp		r	m	s		m	
Calebasse Green. F278. Syn. of Calebasse Vert									
Calebasse Grosse. D'45,374. E'54,392,'59,419. H140,162. Syn. of Van Marum									
Calebasse Imperiale. D'69,873. Syn. of Van Marum									
Calebasse Marianne. K'32,166,'41,136. Syn. of Paradise									
Calebasse Monstre. F278. D'69,873. Syn. of Van Marum									
Calebasse Monstrueuse. D'69,873. Syn. of Van Marum									
Calebasse Monstreuse du Nord. D'69,873. Syn. of Van Marum									
Calebasse Musk. F278. Syn. of Calebasse									
Calebasse Musque. K'32,154,'41,132. D'69,712. Syn. of Calebasse									
Calebasse Oberdieck. EFABC'00. Syn. of Oberdieck									
Calebasse. (Oct.). L. Syn. Calebasse d'Octobre	Belg.	p	l	y	jm		g	m	
Calebasse passe Bosc. Hort'49,194. Syn. of Bosc									
Calebasse Princesse Marianne. D'69,827. Syn. of Paradise									
Calebasse Royale. D'69,873. Syn. of Van Marum									
Calebasse Sterkmans. D'69,698. Syn. of Sterkmans									
Calebasse Tougard. MagofH'55,150 189. D'57,568,'69,713. F278. EFABC'00. Syn. of Tougard.									
Calebasse Vase. K'41,140. D'69,682. Syn. of Capiaumont									
Calebasse Verte. F278. Syn. Calebasse Green	For.								In Field's list of, undescribed varieties.
Calhoun. MassH'43,5. MagofH'45,252,'46,146,'57,250,'49,43. Cult'45,175. D'45,376,'57,478,'69,714. Cole167. E'54,357,'59,369. H141. F272. T'75,542,'85,556,'97,697.	Conn.	robl	m	yru	cogb		g	m	Raised by Governor Edwards, of New Haven, Conn.
Calloresa. MagofH'52,151			l	gy	j	p	g		
Calixte Mignot. EFABC'00. CanExFR'01,547		oblp	ms	yru	bj	p		ml	In experimental orchard at Agassiz, B. C.
Calouet. EFABC'00									In experimental orchard at Agassiz, B. C.
Calua Royal. D'69,863. Syn. of Rose (Sum.)									
Calvin. F'95,37. EFABC'00. CanExFR'05,130	Wash.	ovlp	m	ybst	bjm	sa	g	m	Originated by Calvin Throop.
Camak. R. Syns. Camak's, Camak's Rousselet	Ga.								Orignated by James Camak, of Athens, Ga.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Camak's. A'58,185. AgR'58,394. Syn. of Camak									
Camak's Rousselet. GarM'60,320. Syn. of Camak									
Cambridge Sugar Pear. D'45,392,'57,506,'69,779. MagofH'54,469. E'54,370,'59,389. T'75,542,'85,557,'97,697. Syn. of Harvard.									
Cambroul. L. Syn. Gloire de Cambroul	For								Probably identical with Combrone.
Camburnether. MagofH'38,395									Not described.
Camerling. AgR'56,356. E'59,371. D'69,714. Syns. Camerling d'Allemange Camerlingue, Camerlyn.	Fl	p	m	yb	jm	sp	g	m	A native of Flanders.
Camerling d'Allemange. MagofH'43.125. D'69,714. Syn. of Camerling									
Camerlingue. D'69,714. Syn. of Camerling									
Camerlyn. D'57,479,'69,714. F278. T'75,542,'85,557,'97,697. Syn. of Camerling									
Camille de Rohan. D'69.714. Syn. of Rohan									
Campbell. R. Syn. Bill Campbell	Ala		vl						A supposed seedling of Angouleme.
Camphrenel. R. Syn. Beurre Camphrenel		obot	m	gyru	jm	vs	g	m	Exhibited by Col. M. P. Wilder at meeting of Massachusetts Horticultural Society, 1871.
Canandaigua. MagofH'50,36. B'51,299. Wg69. E'54,357,'59,370. AgR'56,365. D'57,479,'69,714. H141. F272. A'58,57. MoH'69,498. T'75,261,'85,279,'97,458. Syn. Catherine.	Conn	ap	ml	yr	com	v	g	me	Named by Congress of Fruit Growers in 1849.
Canas. L. Syns. Bon Parent, Bouvier, Bow Parent, La Canas, Las Canas	Belg	ovp	ms	gyru	bmj	ap	vg	m	Supposed to have been introduced in 1835.
Candolle. L. Syn. DeCandolle			m		j		g	me	
Canelle d'Ete. D'69,863. Syn. of Bon Chretien (Sum.)									
Cannelle. D'69,674. Syn. of Bosc									
Canner's Japan. T'97,706. HuC'01. Syn. of Golden Russet									
Canning. GenF'33,198. K'41,160. D'45,425,'57,428,'69,751. E'54,317,'59,331. F277. AgR'62,180. T'85,310. Syn. of Easter Beurre.									
Canning d'Hiver. D'69,751. Syn. of Easter Beurre									
Canning Seigneur d'Hiver. T'97,697. Syn. of Easter Beurre									
Canrobert. L. Syn. General Canrobert	Fr	ovp	m	gru	b	p	p	ml	Named for the French General Canrobert.
Cantelope. MagofH'38,231,466,'43,388,'45,437,'49,43. MassH'43,5. Cult'45,175. D'69,714.	Conn	r	s	yr	cobr		g	m	Originated by Governor Edwards, of Connecticut.
Canton. CGenIX,128. P'95,37	Miss	ovt	m	gyb	bj	spr	vg	me	Originated in 1883 in Madison County, Miss.
Cape May. SW. AgR'49,272. D'69,751. Syn. of Easter Bergamot									
Cape May Winter. GarCal587									Published by M'Mahon in Gardeners' Calendar, 1806.
Caperon. L. Syn. Henri Caperon	For								In Field's list of undescribed varieties.
Caperon du Mons. F279									In Field's list of undescribed varieties.

Capiaumont. Pr127. K'32,166,'41,140. Cult'39,66. E'54,357,'59,369. Wg68. D'57,473. H140. F234. T'75,542,'85,557,'97,458. Syns. Aurore, Beurre Aurore, Beurre Capiaumont, Beurre Coloma, Beurre de Capiaumont, Beurre Spence (of some collections), Calebasse Vasse, Capiumont, Cassiomont, De La Glaciere.	Fl.	t	m	yrru	dbm	sv	vg	m	A handsome Flemish pear of fine quality and prolific.
Capiaumont Lints. MagofH'55,146. Syn. of Lints									
Capiaumont (of Boston). K'41,140. Syn. of Wurtemburg									
Capiumont. D'45,357,'69,682. Cole163. F278. Syn. of Capiaumont									
Capron. L. Syns. Docteur Caperon, Docteur Capron	Belg.	ovp	m	ybru	jm	s	g	m	Originated by Dr. John Van Mons in 1842.
Capsheaf. K'32,167,'41,140. MagofH'37,37,52,'48,342. M'38,77,'44,65. D'45,374,'57,480,'69,714. Cult'47,340. Cole159. E'54,357,'59,370. H140. F272. T'75,272,'85,290,'97,468. Syn. Cops Heat.	R. I.	oblp	m	yru	jm	s	g	m	Introduced by S. H. Smith, of Rhode Island.
Captif de St. Helena. E'54,366,'59,379. Syn. of Mars									
Captif de Sainte Helene. Cult'47,340. F281. D'69,819. Syn. of Napoleon									
Captif St. Helene. MagofH'46,338. Syn. of Napoleon									
Capuchin. D'45,375,'57,568,'69,715. Syn. of Capucin									
Capucin. K'41,130. MagofH'42,58,'43,130. D'45,375,'57,568,'69,715. Hort'49,457. E'54,392,'59,419. H140. CGenXXV,94. T'75,542,'85,557,'97,697. Syns. Capuchin, Capucin Van Mons.	Belg.	ovp	m	gyru	mj	v	g vg	ml	Originated by Dr. John Van Mons.
Capucin d'Automne Coloma. F278. D'69,678. Syn. of Coloma									
Capucin Van Mons. MagofH'43,130. MassH'46,252. F279. D'69,715. Syn. of Capucin.									
Carafou. F228. Syn. of Van Marum									
Caraway Pear. DomEncIV,190. Syn. of Heri									
Carcelles. L. Syn. Louise de Carcelles	For.								In Field's list of undescribed varieties.
Cardinale. Pr90. K'32,191,'41,159. GenF'37,278. Syns. Admiral, Poire d'Amiral		oblp		yr	bm	s		l	
Carlsle. R. Syn. Poire Carisie									Published in Magazine of Horticulture, 1851, p. 472.
Carleton. MassH'66,46	Mass.								Originated at Brookline, Mass. Fruited in 1862.
Carlisle. Pr43. K'41,121. D'69,880. Syn. of White Doyenne									
Carnot. R. Syn. President Carnot									In experimental orchard at Agassiz, B. C.
Caroline. MassH'47,69. Syns. Queen Caroline, Reine Caroline	Eur.	p	m	ybr	cr		p	ml	Only fit for the kitchen.
Cartofel. D'57,570,'69,724. Syn. of Aremberg Colmar									
Caslebirne. L. Syn. La Caslebirne	For.								Published by Field; not described.
Cassaire. L. Syn. Trompe Cassaire.		r	m	g	t				Published by Prince, p. 134.
Cassante. L. Syn. Cassante de Mars	Belg.	obo		gy	mj	svp		vl	Said to have originated with Maj. Esperen.
Cassante de Brest. Pr65. F280. Syn. of Brest									
Cassante de Mars. MagofH'48,111. D'57,479,'69,715. F278. E'59,370. T'75,542,'85,557,'97,697. Syn. of Cassante.									
Casserule. D'69,715. MassH'71,39	Eur.	oblp	ml	ybru	coj	a	g	l	
Cassiomont. Pr127. K'32,166. Syn. of Capiaumont									
Cassolette. Pr31. K'32,137,'41,119. GenF'37,277. MagofH'38,390,'43,130,'50,295. Cult'50,15. A'54,238. Syns. Friolet, Green Muscat or Eche frion, La Cassolette, Lechefriand, Lechefrion, Muscat Verd, Muscat Vert, Petite Cassolette, Poire de Sillerie, Small Cassolette, Verdasse.			s	gr	b	sp		me	Old and probably obsolete.
Castelline. D'69,715. EFABC'00	Belg.	robtp	m	gyru	jbm	s	g	l	In experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Castle Garden. OH'91,18	Ohio								From seed of a pear purchased at Castle Garden, N. Y.
Catalac. Cole174. Syn. of Catillac									
Cat Burnt. Pr89. K'32,152. Syn. of Chat Brusle									
Catchet. L. Syn. Adolphe Catchet	Fr	obtp	m	yr	gj	vs		me	Originated by Andre Leroy, of Angers, France.
Catharine. Th186. Syn. Beurre Catherine									Published in Magazine of Horticulture, 1843, p. 130, as Beurre Catherine.
Catharine. Pr20. IndF'40,182. Syn. of Early Rousselet									
Catharine Gardette. A'56,90,'99,15. AgR'56,368. D'57,479,'69,715. F272. T'85,557. Syn. of Gardette.									
Catherine. MagofH'50,36. B'51,299. Wg68. E'54,357,'59,370. D'57,479,'69,714. Syn. of Canandaigua.									
Catherine Gardette. Cult'57,141. E'59,370. T'75,542,'85,557,'97,697									Mentioned as new by Dr. W. D. Brinckle in 1857.
Catherine Lambre. MagofH'54,235. F279. D'69,716. T'75,542,'85,557,'97,697. Syn. of Lambre (Catherine).									
Cathinka. AgR'54,243,'58,421									Catalogued by R. H. Robey, of Virginia.
Catillac. Pr109. K'32,150,'41,128. M'38,95,'44,83,'47,84. Cult'39,66. D'45,432,'57,568, '69,716. B'51,211,'83,379. Wg69. AgR'54,297. E'54,392,'59,419. H141. F279. A'62,66. MoH'69,498. T'75,287,'85,305,'97,478. Syns. Bell, Besi de Maraise, Black Pear of Worcester, Bon Chretien d'Amiens Chartreuse, Cadillac, Catalac, Chartreuse, Cotillard de Livre, De Bell Argentine, De Citronille, De Gros Rateau Raisenette, De Tout Temps, 40 Ounce, Franc Real, Grand Mogul, Grand Monarque, Grand Tamerlan, Groote Mogul, Gros Gilot, Gros Rateau, Gros Rateau Gris, Gros Thomas, Katzenkop, Love Pear, Misporde Benoist, Monstre, Monstreuse de Landes, Parkinson's Warden, Poire d'Une Livre, Pound Pear, Quarante Onces, Roi de Louvain, Tete de Chat, Teton de Venus.	Fr	t	vl	ybr	cog		g	vl	Scarcely eatable except when cooked.
Catinka. MagofH'48,111,'57,165. B'51,315. Hort 54,310. E'54,357,'59,370. D 57, 480, 69,716. H141. F278. A'62,66. T 75,542,'85,557,'97,478.	Belg	obop	sm	yru	gbmj	v	g vg	ml	Raised by Maj. Esperen.
Cavalier de la Salle. EFABC'00. Syn. of Lasalle									
Cecil. L Syns. Admiral Cecile, Amiral Cecil	Fr	rov	ms	yb	jmg		g	ml	
Cedarmere. Hort'63,279. D'69,716	N. Y.	r	s	gyru	jm	s	g	me	Originated by W. C. Bryant, at Roslyn, Long Island, N. Y.
Celeste. F210,277. Syn. of Diel									
Celestin. MagofH'46,179. HovI,9. E'54,343,'59,413. Syn. of Le Clerc (Van Mons)									
Celestus. D'69,777. Syn. of Hacon									
Cellite. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar									
Cent Couronnes. MagofH'51,472. F279. D'69,822. Syn. of Oken									
Centennial of Ohio. WNYH'99,91. Syn. of Louise									

Century. MoH'83,77. MichB31. BB1.									"A very old variety from Philadelphia." Transactions of Missouri State Horticultural Society, 1883, p. 77.
126 **Cercle.** L. Syns. Beurre de Cercle, Beurre de Cercle Practique de Rouen, Beurre du Cercle, Pratique de Rouen.	Fr	oblp	ms	yru	gjm	sv	g	m	According to Downing, but little known.
Certeau. R. Syn. Certeau d'Automne									In experimental orchard at Agassiz, B. C.
Certeau d'Automne. EFABC'00. Syn. of Certeau									
Certeau d'Ete. D'69,717. Syn. of Summer Certeau									
Certeau Madam. D'69,758. Syn. of Jargonelle (Eng.)									
Certeau Musque d'Hiver. D'69,814. Syn. of Sire									
Cesile. K'41,140		r	l	rru	b		vg	m	Greatly resembles Gansel Bergamot; Kenrick.
Chair a Dame. Pr34. K'32,130. MagofH'37,49,'38,390,'50,295. M'38,70,'44,55. A'54 238. F279. D'69,837. Syn. of Prince.									
Chamaret. L. Syn. Jacques Chamaret	Fr	rp	m	yr	djm	sv	g-vg	m	A seedling raised by Leon Leclerc, at Laval, France.
Chambers. Hort'70,263. AJofHVIII,293. GarM'72,250. IllH'72,323. MassH'74, 157. A'75,37. Dap174. MichH'93,98. FESofO'97,11. CanH'01,451,'03,130. Bul6,8. AHM238. Syns. Chambers' Hybrid, Early Harvest, Early Harvest (of Ky.).	Md? Ky?	robo	m	yr	cojm	s		ve	Origin claimed for Maryland and Kentucky, respectively.
Chambers' Hybrid. IllH'95,55. Syn of Chambers									
Chambers' Large. E'54,334,'59,346. D'69,835. Syn. of Pound									
Chambers' Large. D'45,448. Syn. of Tonneau									
Chambord. L. Syns. Comte de Chambord, Comtesse de Chambord	Fr	obtp	sm	yg	gm	svp		ml	Originated at Poictiers, France.
Chambrette. Pr87. K'32,149,'41,124. GenF'33,197. D'45,450,'57,584,'69,877. E'54, 400,'59,125. F283. Syn. of Virgouleuse.									
Chambrette d'Hiver. D'69,877. Syn. of Virgouleuse									
Chamoisine. Hort'54,309,'60,31. D'69,802. Syn. of Liebart									
Champagne. R. Syn. Champagne Longue									Has proved hardy in Ontario. Canada.
Champagne Longue. FGAofO'92,97. Syn. of Champagne									
Champe Riche d'Italie. K'41,124. Syn. of Italie									
Chanceller. Hort'49,567,'56,155 B'51,315. A'54,141,'62,66,'99,15. Cult'56,339. AgR'56,347. MagofH'53,63. E'54,358,'59,371. D'57,481,'69,717. H141. F271. T'75,261. '85,279,'97,458. Syns. Early German, Early St. Germain, Green's Germantown.	Pa	obtp	ml	gyru	jbm	sp	g	m	Thought to have originated at Germantown, Pa.
Chandelle. D'69,758. Syn. of Jargonelle (Eng.)									
Chantenay. R. Syn. Remy Chantenay									In the experimental orchard at Agassiz, B. C.
Chantry. R. Syn. Chantry Seedling									Published in Magazine of Horticulture, 1843, p. 125.
Chantry Seedling. MagofH'43,125. Syn. of Chantry									
Chapelle. L. Syn. Beurre de la Chapelle, Bonne de la Chapelle	Fr	robp	m	gyru	jco		g	ml	Found in the woods near Nantes, France, in 1845.
Chapeau. A'52,27. E'54,363,'59,378. Syn. of Goubault (Doyenne)									
Chapman. MassH'47,90. MagofH'48,84. B'51,315. E'54,392,'59,419. F272. D-'69,717.	Pa?.	obop	m	gyb	m	a	p	me	Downing called it poor.
Chapman's. Pr101. GenF'33,197,'37,278. D'45,444,'69,829. E'54,380,'59,403. Syn. of Passe Colmar.									
Chaptal. L. Pr109. K'32,191,'41,169. GenF'33,197. Cult'39,66. B'51,311. E'54, 358,'59,371. H141. IllH'63,22,'69,156. D'69,717. T'75,542,'85,557,'97,697. Syn. Beurre Chaptal.	Fr	obtp	ml	gy	m	a	g-vg	l	Variable in quality; sometimes very good.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Charbonniere. D'69,722. Syn. of Collins									
Charles. D'69,819. Syn. of Napoleon									
Charles Basiner. D'69,717. Syn. of Basiner									
Charles Bivort. D'69,717. Syn. of Bivort (Chas.)									
Charles Cognee. WNYH'88,129. AofH'91,296. EFABC'00. CanExFR'03,422. Syn. of Cognee.									
Charles d'Autriche. Pr195. GenF'37,277. D'45,376,'57,569,'69,733. E'54,392,'59,419. H142. Syn. of Hardenpont (Belg.).									
Charles d'Autriche. K'32,167,'41,141,149. GenF'33,197. D'45,401,'57,526. Cult'47,340. Syn. of Napoleon.									
Charles Delight (1). L. Syns. Delices Charles, Delices Charles Van Mons, Delices de Charles, Wredow.	Belg	obop	m	gyru	jm	vs	......	m	Originated by Dr. John Van Mons.
Charles Delight (2). L. Syn. Delices Charles	Belg	obo	ml	gru	b			me	Originated by Bouvier.
Charles Ernest. EFABC'00. Syn. of Ernest									
Charles Frederick. D'57,480,'69,718. F278. T'75,542,'85,557,'97,697	Belg	robop	m	yrru	b	sv	g	me	Originated by Dr. John Van Mons.
Charles Gocnee. AndN'95. Syn. of Cognee									
Charles of Austria. Pr195. K'32,167. GenF'37,277. D'45,376,'57,569. Cult'47,340. E'54,392,'59,419. F279. MoH'59,21,31. T'75,542,'85,557,'97,697. Syn. of Hardenpont (Belg.).									
Charles Smet. D'57,480,'69,718. T'75,542,'85,557,'97,697. Syn. of Smet									
Charles Smit. F278. Syn. of Smet									
Charles Smith. D'69,718. Syn. of Smet									
Charles Van Hooghten. MagofH'51,472. MassH'51,189. Hort'53,30. A'54,44. AgR'54,245,'56,330. D'57,480,'69,718. T'75,542,'85,557,'97,697. Syn. of Van Hooghten.									
Charles Van Hoogten. E'54,358,'59,371. Syn. of Van Hooghten									
Charles Van Houghten. F278. Syn. of Van Hooghten									
Charles Van Houten. Hort'70,355. Syn. of Van Hooghten									
Charles Van Mons. MagofH'50,295. A'54,238. E'54,358,'59,371. H142	For	obop	ms	ygbr	mj	v	vg	l	
Charlotte. L. Syns. Bon Chretien de Turc, Bon Chretien Flemish, Bonne Charlotte			m	y	db	sp	g	me	Rots at core if not gathered early.
Charlotte de Brower. K'41,170. MassH'51,189. D'57,481,'69,718. F278. MagofH'52,39,'56,218,'57,472. T'75,542,85,557,'97,697. Syn. of De Brower.									
Charlotte (Princess). L. Syns. Princess Charlotte, Princesse Charlotte	Belg	obtp	m	g	mj	s	g	ml	Raised by Major Esperen.
Charneau. EFABC'00. CanExFR'04,480. Syn. Koftliche von Charneau		ap	s	rubr	jm	s	......	m	In experimental orchard at Agassiz, B. C.
Charneau. T'97,697. Syn. of Brabant									
Charron. L. Syn. Beurre Charron	Fr	r	m	y	jmb	......	vg	m	Originated at Angers, France, in 1838.
Chartreuse. F279. Syn. of Catillac									
Chartreux. L. Syns. Poire des Champs des Chartreux, Poire des Chartreux	For		l	y	bm	s	......	me	
Chase. MagofH'36,79									Not described.

Chasseurs. D'69,735. Syns. Des Chasseurs, Hunter, Poire des Chasseurs, Sportsman.	Belg	obtp	m	gyru	bjg	p	g-vg	m	Supposed to have originated with Dr. John Van Mons.
Chat Brule. Pr89. K'32,152. MagofH'43,130. A'54,238,56,12. Syn. of Chat Brusle.									
Chat Brusle. Pr89 K'41,125. Syns. Burnt Cat, Chat Brule, Cat Burnt, Chat grille, Pucelle de Saintonge, Pucelle de Haintonge (erroneously), Virgin of Haintonge (erroneously).		p		yr				ml	Possibly same as Saintonge.
Chat Brusle. Pr82. Syn. of Saintonge.									
Chatenay. L. Syn. Beurre Chatenay	Fr.	ovp	s	yru	dj	sv	vg	m	Too small for profit but fine in quality.
Chat Grille. Pr89. MagofH'50,295. Cult'50,45. Syn. of Chat Brusle.									
Chattanooga MassH'66,43	Mass.	t	ml	g	jm	sp	vg	m	Originated at Brookline, Mass. Fruited in 1863.
Chaudy. R. Syns. Beurre Chaudy, Madame Chaudy									In experimental orchard at Agassiz, B. C.
Chaulis. Pr82. K'32,138. D'69,815. Syn. of Messire.									
Chaumoisine. F279	For.								In Field's undescribed list.
Chaumontel. Th186. Pr94. K'32,143,'41,123. GenF'33,196,'37,278. D'45,433,'57,560,'69,718. Cole172. AgR'50,95,'54,252. B'51,309. E'54,359,'59,372. H142. F279. T'85,305,'97,478. Syns. Beurre de Chaumontel, Beurre d'Hiver, Beurre d'Hyver, Besi Chaumontel, Bezi de Chaumontelle, Bezy de Chaumontel, Bon Chretien de Chaumontel, Chaumontelle, Oxford Chaumontel, Poire de Chaumontelle, Shaumontel, Shaw-Montel, Winter Beurre, Winter Butter.	Fr.	p	l	ybr	bm	sp	g	vl	Named for the village of Chaumontel, France.
Chaumontel Anglaise. F282. Syn. of Pain et Vin.									
Chaumontel d'Ete. D'57,514. F280. E'59,421. Syn. of Jargonelle (Fr.).									
Chaumontelle. GarCal587. Th186. Wg69. Syn. of Chaumontel.									
Chaumontel Swan. R. Syn. Chaumontel Swan's Egg	Eng.								Seedling of Swan Egg raised by J. Williams, of Pitmaston, England.
Chaumontel Swan's Egg. MagofH'39,304. Syn. of Chaumontel Swan.									
Chaumontille Tres Gros. GenF'33,198. D'45,425,'57,428,'69,751. E'54,317,'59,331. H142. F277. T'97,697. Syn. of Easter Beurre.									
Cheat Servant. Pr122. D'69,658. Syn. of Ambrette.									
Chelmsford. MagofH'40,18,19,'41,168. GenF'41,91. D'45,370,'57,569,'69,719. Hort'47,175. Cole161. WHRIV,204. E'54,393,'59,420. AgR'56,347. H142. F272. A'62,66. T'75,542,'85,557,'97,697. HMHS15. Syns. Mogul Summer, Stone, Tynsboro, Tyngsboro.	Mass.	robtp	l	yr	co	s	g	me	Probably identical with Stone. See WHRIV, p. 204.
Chenau. Pr65. Syn. of Brest.									
Chene Vert. F282. Syn. of Pain et Vin.									
Chene Vin. F282. Syn of Pain et Vin.									
Chenille. Cult'47,340. AgR'56,345. D'69,828. NYC'90. Syn. of Portugal.									
Cher Adame. Pr34. K'32,130,'41,119. D'69,837. Syn. of Prince.									
Cheropay. CanH'94,293									Not described.
Cherroise. F279	For.								Do.
Chevalier. D'69,673. Syn. of Bachelier.									
Chevalier d'Onyn. MagofH'55,146. Syn. of Onyn.									
Chevaliers de Stuttgardt. D'69,847. Syn. of Stuttgart.									
Chilton. MassH'66,45	Mass.								Originated at Brookline, Mass. Fruited in 1865.
Chinese Bergamot. AofH'92,776.									Not described.
Chinese d'Engery. NebH'90,130. WisHort Aug'98. TexB16. EFABC'00.	China?								Said in Transactions of Nebraska Horticultural Society, 1890, p. 130, to be of Chinese origin.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Chinese Pear. A'75,66. GaH'76,17,'78,29. B'83,371. PJB. Syn. of Le Conte									
Chinese Sand Pear. D'69,851. GaH'78,29. IndH'78,63,'83,47. CanH'79,93. MichH'80,347. Bl229. OH'81,21. FGAofO'82,50. Ha250. T'97,697. Syn. of Sha Lea.									
Chinese Snow Pear. IndH'79,49,'85,47. Bl229,244. Syn. of Suet Lea									
Ching Sand. NYC'90									On trial at the Geneva (N. Y.) Experiment Station.
Chinnilla. MoH'96,36									Not described.
Chiot. Pr129. D'69,802. Syn. of Little Muscat									
Chisel. L. Syns. Green Chisel, Green Sugar (of some English Gardens), Guenette, Hastiveau, Hativeau, Madeleine, Petit Muscat, Sugar.	Eng.	rov	s	g	mjg	v	g	me	An old and formerly popular early variety.
Choice d'un Amateur. MagofH'55,318. E'59,371. Syn. of Poiteau									
Choice of an Amateur. F279. Syn. of Poiteau									
Choisnard. D'69,719. MassH'71,40	Fr.	oblp	ml	yb	cdjg	p		vl	Originated by M. Choisnard, of Ormes.
Choix d'un Amateur. D'69,821. Syn. of Poiteau.									
Cholwell. MagofH'47,451	Eng.								Robert Thompson in Journal of London Horticultural Society.
Chomel. MagofH'43,130									Possibly identical with Cholwell of Thompson.
Chomier. R. Syn. Alexander Chomier									In experimental orchard at Agassiz, B. C.
Chopine. D'69,758. Syn. of Jargonelle (Eng.)									
Christmas. E'54,358,'59,371. H142. F272. Syn. Noel	Ohio.	rov	m	bru	gj	s	vg	l	From Cincinnati, Ohio. First described by Dr. Warder.
Christmas Beurre. MassH'74,158. Syn. Seedling Virgalieu No. 4	Mass.	ovp	m	gr	j		vg-b	l	From seed of White Doyenne; originated at Williamstown, Mass.
Chrouch. D'69,730	Conn.	robl	ms	yru	jm	s	g	me	Originated at Colchester.
Church. Hort'56,509,'57,114,434. A'56,199. MagofH'57,112,'59,150. D'57,430,'69,719. F236,271. E'59,372. CGenIX,191. MichH'84,261. Cult'65,76. T'75,283,'85,301,'97,475. IllH'89,346. Syns. Clarke, Platt's Bergamot.	N. Y.	robo	sm	gyru	bjm	sp	vg	me	Originated at Trinity Church, New Rochelle, N. Y.
Cincincis. NYC'90. Syns. Cin Cin Cis, Japanese	Fr.								Imported to Ohio about 1858 as a stock. Not described.
Cin Cin Cis. OH'74,12. IndH'78,64. Bl229,244. Syn. of Cincincis									
Cinnamon. R. Syn. Cinnamon Pear									Exhibited by E. Mallinckrodt, at St. Louis, September, 1847.
Circe. F278. Syn. of Little Blanquet									
Cire. R. Syn. Poire Cire									Published in Magazine of Horticulture, 1852, p. 39.
Ciree d' Hiver. D'69,772. Syn. of Gilogil									
Citrina. MassH'66,45. D'69,720. A'69,101. AHortA'69,79. AJofHIV,288	Mass.	p	m	y	cogj	sp	vg	me	Originated at Brookline, Mass. Fruited in 1862.
Citron. MagofH'38,231,'41,146. D'45,336,'57,481,'69,720. Cult'45,175. E'54,360,'59,372. H142. F272. T'75,542,'85,557,'97,697.	Conn.	rt	s	gb	cojm	svp	g	me	Originated at New Haven, Conn., by Governor Edwards.

Citron. T'97,698. Syn. of Beurre Citron									
Citron de Carmes. WHR1,130. T'75,542. Syn. of Madeleine									
Citron des Carmes. C178. Pr13. K'32,129,'41,118. GenF'33,196,'37,277. M'38,64 Cult'39,66,'44,36. MagofH'43,262. D'45,341,'57,441,'69,809. AgR'54,249,'63,125. E'54,331,'59,343. Cole151. Wg72. T'85,557,'97,698. B'83,364. Syn. of Madeleine.									
Citron des Carmes a Long Queue. F279	For								In Field's list of undescribed varieties.
Citron des Carmes panache. L17. Syn. of Madeleine (Var.)									
Citron des Carmes Panache. E'54,331. Syn. of Striped Madeleine									
Citron de Septembre. Pr43. GenF'33,196. D'45,378,'57,436,'69,880. F279. AgR'62,183. Syn. of White Doyenne.									
Citron de Sirens. Cult'50,45. Syn. of Citron de Sirentz									
Citron de Sirentz. M'38,69'44,55. K'41,130. Syns. Citron de Sirens, Citron de Sirenz.							p		Not cultivated by Mr. Robert Manning.
Citron de Sirenz. A'54,238. Syn. of Citron de Sirentz									
Citronenbirne Bomische Grosse punctirte. D'45,392,'57,574,'69,775. Syn. of Bohemia									
Citron of Bohemia MassH'44,60. MagofH'50,296. A'54,238. E'54,392,'59,419. Syn. of Bohemia.									
Clair. D'45,375,'57,560,'69,720. E'54,392,'59,419. F279. Syn. of Clara									
Clairgeau. D'69,678. S92. Bl228,239. MichH'88,119. IllH'90,108. T'97,478. Bul6,8. AHM238 Syns. Beurre Clairgeau, Beurre Clairgleau, Clairgeau de Nantes.	Fr.	p	l	yrub	gbj	svp	g	ml	Raised by Pierre Clairgeau, of Nantes.
Clairgeau de Nantes. H129. D'69,678. Syn. of Clairgeau									
Clap. Pr145. D'69,720. Syn. of Clapp									
Clapp. MagofH'50,295,431. Cult'50,45. A'54,238. HMHS222. Syn. Clap	Mass.	ap	ms	ygb	bj	p		me	Prince and Downing spelled this with one *p;* a mistake.
Clapp. S89. Bul6,8. Syn. of Clapp Favorite									
Clapp Beauty. R. Syn. Clapp's Beauty (No. 64)									Not described.
Clapp's Beauty (No. 64). CBCo'95. IllH'96,209. Syn. of Clapp Beauty									
Clapp Favorite. Hort'73,341. ColoH'97,90,91. AHM238. Syns. Clapp, Clapp's Favorite, Clapp's No. 3.	Mass.	obtp	l	ybru	bjm	svp	g	me	Originated by Thadeus Clapp, of Dorchester, Mass.
Clapp's Favorite. MassH'60,50,'68,11. AJofH'67,42. AgR'62,193. AHortA'68,78,79,77. D'68,720. IllH'69,53,'70,297,'71,44. IaH'71,82. T'75,251,'85,269,'97,452. B'83,363. WnI,324 II,334 III,258. CanH'98,39. Syn. of Clapp Favorite.									
Clapp No. 1. MassH'60,50,'73,98,'74,153,'75,119									A seedling of Flemish raised by T. Clapp; not promising.
Clapp No. 2. MassH'60,50,'73,98,'76,92									Raised by T. Clapp; thought to be from seed of Seckel.
Clapp No. 3. MassH'60,50,'74,153. HMHS383. Syn. of Clapp Favorite? Syn. of Harris?									Clapp No. 3 in MassH'60,50 as Clapp Fav.; in '74,153 as Harris; which?
Clapp No. 4. MassH'60,50. Syn. of Dorchester									
Clapp No. 12. A'73,68. MassH'77,80. Syn. of Newhall									
Clapp No. 15. A'75,46									Said by Comt. to have been very attractive.
Clapp No. 17. MassH'75,119,'76,94,'77,80. Syn. of Nicholas (Mass.)									
Clapp No. 20. MassH'60,50. A'75,46									Resembles Marie Louise; not promising.
Clapp No. 21. MassH'62,32. A'62,151									Exhibited by Mr. Clapp at Mass. Hort. 1862,32; promising.
Clapp No. 22. MassH'73,98,'74,153,'75,119,'76,94. A'75,38,66,119,'77,104. Dap148. FGAnO'79,43. WNYH'79,53. HMHS283. Syn. of Fred. Clapp.									
Clapp No. 24. A'75,46									Unusually attractive in form and coloring.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Clapp No. 25. A'75,46									Has a fine appearance.
Clapp No. 36. A'75,46									Beautiful.
Clapp No. 50. A'75,46									Exhibited by Messrs. Clapp at Amer. Pom. Socy., 1875.
Clapp No. 56. MassH'70,31									Large, fine quality, and promising.
Clapp No. 64. MassH'75,117,118,'76,92,'78,172,'79,159,160. A'75,66,119,'79,96'81,96. FGAofO'86,22. HAJ'87,14. WNYH'87,149. Syn. of Clapp Beauty.									
Clapp No. 65. MassH'75,118. A'75,66,119									Supposed to be from seed of Anjou.
Clapp's No. 72. Hort'72,216									Resembles Bartlett and is of great promise.
Clapp's No. 73. Hort'72,216									From Rural New Yorker; represented as very promising.
Clapp No. 75. MassH'73,98,'74,153,'75,119,'77,80									Resembles Winter Nelis and is highly commended.
Clapp No. 107. A'75,66,119. MassH'81,232									In size, form, and color like Bartlett.
Clapp No. 111. A'75,46									Attractive in appearance.
Clapp No. 117. A'75,46									Beautiful.
Clapp No. 125. MassH'74,153,'75,118. A'75,66,119									An October variety of fair promise.
Clapp No. 127. MassH'75,119,'77,80									From seed of Urbaniste; quality fine.
Clapp No. 137. MassH'73,97									Of the Bartlett type, but not promising.
Clapp's Seedling. EFABC'00									In the experimental orchard at Agassiz, B. C.
Clara. MagofH'42,58,'50,295. D'45,375,'75,569,'69,720. Hort'49,457. A'54,238. E'54,392,'59,419. H143. F279. T'75,542,'85,557,'97,698. Syn. Claire.	Belg	ovp	m	yr	mj	sa	g p	m	Originated by Dr. John Van Mons.
Clark. MagofH'53,518,'58,126									President Clark, probably identical.
Clarke. A'58,58. D'69,719. Syn. of Church.									
Claude Blanchet. EFABC'00. Syn. of Blanchet.									
Clavier. R. Syn. Martin Clavier									In the experimental orchard at Agassiz, B. C.
Clay. MassH'43.5. MagofH'45,437,'49,43. D'57,481,'69,721. F272. T'75,542,'85,557,'97,698. Syn. Sponge.	Conn	roblp	m	yb	cogj	s	g	m	Raised by Gov. Edwards at New Haven, Conn.
Clemence. D'69,722. Syn. Clementine.	Belg	obop	m	yru	gjm	s	vg	me	Originated by Dr. John Van Mons in 1833.
Clement Bivort. D'69,722. Syn. of Bivort (Clem.).									
Clement Doyenne. D'57,421,'69,666. F276. Syn. of Bartlett									
Clementine. D'69,722. Syn. of Clemence									
Clinton. MagofH'42,60,'51,263. D'45,376,'57,569,'69,722. APC'50,11. A'54,238. E'54,392,'59,419. H143. F279. T'75,542,'85,557,'97,698. Syn. Van Mons No. 1238.	Belg		m	y	db		p	m	Originated by Dr. John Van Mons.

Clion. K'41,160. D'45,448,'57,557,'69,875. Cole168. WHRI,64. HovI,47. E'54,344,'59,354. H143. F283. AgR'58,410,'62,189. A'58,173. T'75,542,'85,557,'97,698. Syn. of Vicar.									
Cluster. K'41,130. MagofH'43,130,'50,430. D'69,729. Syn. of Cornwell									
Cluster Hybrid. EWK'01									Not described.
Cluster Pear. E'59,387. Syn. of Hampton Cluster									
Cocklin. R. Syns. Cockling, Cocklin's Hybrid									A hybrid of Louise and Sha Lea, if not the latter.
Cockling. MoH'87,96. Syn. of Cocklin									
Cocklin's Hybrid. IaH'79,304. IndH'79,49. MichH'80,84. MichB31. NYC'90. AofH'92,276. PaB18. Syn. of Cocklin.									
Cocklin's Sha Lea. Ha256. Syn. of Sha Lea									
Collin. L. Syns. Doyenne d'Hiver, Collin's Virgalieu	For.	robo	ml	y	j	s	p	l	
Collin's Virgalieu. MassH'45,89. MagofH'38,395,'50,39. E'54,394,'59,420. T'75,543,'85,557,'97,698. Syn. of Collin.									
Cognee. R. Syns. Charles Cognee, Charles Goenee		ovp	s	yru				l	Mentioned in a list of twenty-five late varieties.
Coit. E'54,319. Syns. Beurre Coit, Coit's Beurre	Ohio	obtp	m	yru	cojm	v	vg	me	Originated by Col. Coit, near Cleveland, Ohio.
Coit's Beurre. E'54,319. D'57,480,'69,722. F272. H145. Hort'64,110. AHortA'70,70. T'75,543,'85,557,'97,698. B'83,379. Syn. of Coit.									
Collet. Hort'52,482. Syn. of Jargonelle (Fr.									
Cole. P'95,37. Syn. Cole's Winter	Aust.	obtp	m	ru	jm	sa	vg	m	Scions received at Gardenia, Va., from Austria.
Cole (Kans.). R. Syns. Cole, Cole's Coreless, Cole's Coreless and Seedless, Cole's Pear, Cole's Seedless, Seedless.	Kans								Said to have originated at Detroit, Kans.
Cole. AHM239. Syn. of Cole (Kans.)									
Cole's Coreless IllH'96,204,214. Syn. of Cole (Kans.)									
Cole's Coreless and Seedless. JBW&B'92. Syn. of Cole (Kans.)									
Coleman. R. Syn. Coleman's Butter									In experimental orchard at Agassiz, B. C.
Coleman's Butter. CanExFR'96,135. Syn. of Coleman									
Cole's Pear. ChNC'93. AN&OCo. Syn. of Cole (Kans.)									
Cole's Seedless. MoH'96,28. CanExFR'00,462. EFABC'00. Syn. of Cole (Kans.)									
Cole's Winter. P'95,37. Syn. of Cole									
Colin Noir. D'69,722. Syn. of Collins									
Colis. NIH'95,154	Tenn.?								From Tennessee. New and a late keeper.
Collins. MagofH'50,525,'51,255,'52,149. MassH'51,188. HovII,35. E'54,360,'59,372. AgR'56,195. D'57,482,'69,722. H143. F272. A'56,201. T'75,272,'85,290,'97,468. Syns. Charbonniere, Colin Noir, Malconnaitre, Meconnaitre, Watertown.	Mass.	rap	sa	gyru	djm	s	vg	m	Raised by A. Collins, of Watertown, and exhibited in 1848.
Colmar. GerCal587. SW. Pr99. K'32,144,'41,125. GenF'33,196,'37,278. Cult'39,66. D'45,131,'57,570,'69,723. E'54,393,'59,420. H145. F279. T'75,543,'85,557,'97,479. Syns. Bellect Bonne, Belle et Bonne d'Hiver, Bergamotte Royal d'Hiver, Bergamotte Tardive, Colmar d'Hiver, Colmar Doree, Colmars, Colmart, Commodore, D'Auch, De Maune, Gracieuse, Incomparable, Late Bergamot, Manna and Manne Maune, Pear d'Auch, Poire de Colmar, Poire Manne, Winter Bergamot, Winter Vergalieu.	Belg.	obtp	ml	y	mbj	s	vg	l	An old variety.
Colmar Artoisenet. MagofH'52,299. WHRII,559. F279. D'69,723. Syn. of Artoisenet.									
Colmar Boise. D'69,772. Syn. of German Muscat									
Colmar Bonnet. B'51,315. D'69,829. T'75,543,'85,557,'97,698. Syn. of Passe Colmar.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Colmar Bosc. D'45,401,'57,526,'69,821. E'54,398. F281. T'75,543,'85,558,'97,698. Syn. of Niell.									
Colmar Charnay. WHRI,46. D'57,452,'69,662. F276. Syn. of Courbe									
Colmar Charnay. E'54 388,'59,417. Syn. of Farragut									
Colmar d'Alost. Hort'53,66. D'57,482,'69,724. MagofH'57,168. E'59,372. T'75,543,'85,558,'97,698. Syn. of Alost.									
Colmar d'Aremberg. K'41,169. MagofH'47,188,'48,110,'55,515. B'51,315. HovII,83. WHRIII,161. E'54,393,'59,420. D'57,570,'69,724. AgR'54,297. H144. F279. T'75,543,'85,558,'97,698. EFABC'00. Syn. of Aremberg Colmar.									
Colmar d'Automne. K'41,141. F277. Syn. of Beurre Colmar									
Colmar d'Automne Nouveau. F279. D'69,724. Syn. of New Colmar									
Colmar d'Ete. K'32,154,'41,131 D'57,570,'69,724. F279. T'75,543,'85,558,97,698. AofH'90,202. CanExFR'98,400. Syn. of Summer Colmar.									
Colmar d'Ete. Pr36. Syn. of Swan Egg									
Colmar d'Hiver. D'69,723. Syn. of Colmar									
Colmar d'Hiver. K'32,193. GenF'37,278. Syn. of Gloria									
Colmar d'Hiver. D'45,437,'57,503. HovI,5,7. E'54,325,'59,339. F216. AgR'62,185. T'75,543,'85,558,'97,698. Syn. of Glout Morceau.									
Colmar d'Hiver. E'54,380,'59,403. Syn. of Passe Colmar									
Colmar d'Hiver. D'69,884. Syn. of Winter Nelis									
Colmar de Jonghe. D'69,724. Syn. of Jonghe Colmar									
Colmar Delahaut. MagofH'57,155,259. Dap124. Syn. of Delahaut									
Colmar de Lot. D'69,668. Syn. of Dumas									
Colmar de Maruix. EFABC'00. Syn. of Maruix									
Colmar de Meester. E'59,420. D'69,725. Syn. of Meester									
Colmar Deschamps. K'32,188,'41,156. D'45,423,'57,462,'69,680. HovI,1. E'54,314,'59, 326. F230. AgR'65,188. Syn. of Aremberg.									
Colmar de Silly. F279. E'59,403. D'69,829. Syn. of Passe Colmar									
Colmar des Invalides. F279. Hort'64,211. D'69,725. Syn. of Invalides									
Colmar Dewez. K'32,192,'41,160. MagofH'39,395	Belg				mj	p			Originated near Brussels shortly before 1840.
Colmar Dore. Pr151. Syn. of Colmar (Golden)									
Colmar Doree. GenF'33,196. D'45,434,'69,723. E'54,393,'59,420. Syn. of Colmar									
Colmar Doree. D'45,444,'57,532. E'54,380,'59,403. F281. Syn. of Passe Colmar									
Colmar du Lot. MassH'51,189. MagofH'52,39									Not described.
Colmar Dumortier. EFABC'00. CanExFR'03,422		obtp	m	gyru				l	Cultivated at experimental farm, Agassiz, B. C.
Colmar Early. L16. Syn. of Summer Colmar									
Colmar Epine. MagofH'42,58. D'45,376,'57,570,'69,725. E'54,360,'59,372. H144. F279. T'75,543,'85,558,'97,698. Syn. of Thorny Colmar.									
Colmar Epineaux. Pr101. K'32,196. GenF'33,197. Cult'39,66. D'69,829. Syn. of Passe Colmar.									
Colmar (Golden). Pr151. Syn. Colmar Dore									Possibly identical with Colmar.

Colmar Gris. D'45,444,'57,532,'69,829. E'54,380,'59,403. F254,281. T'75,543,'85,558, '97,698. Syn. of Passe Colmar.									
Colmar Hardenpont. GenF'33,197. K'41,164. D'45,444,'57,532,'69,829. E'54,380,'59, 403. F254,281. T'75,543,'85,558,'97,698. Syn. of Passe Colmar.									
Colmar Jaminette. D'45,438,'57,513,'69,790. E'54,372,'59,392. F281. Syn. of Jaminette.									
Colmar Musque. B'51,315. F279. D'69,829. Syns. Passe Colmar Musque, Passe Colmar Musque d'Automne.	Belg.	roblp	m	gyru	bjm	p	g	m	Raised by Major Esperen.
Colmar Navez. D'57,460,'69,695. F272. T'75,543,'85,558. Syn. of Navez									
Colmar Neill. MagofH'40,46. D'45,376,'57,569. E'54,359,'59,373. H144. F279. T'75, 543,'85,558,'97,698. Syn. of Niell.									
Colmar Nelis. F205,283. D'69,884. EFABC'00. Syn. of Winter Nelis									
Colmar Niel. Cult'39,66. MassH'47,69. D'69,821. T'85,558. Syn. of Niell									
Colmar Precoce. D'57,570,'69,724. Syn. of Summer Colmar.									
Colmar Preul. Pr101. D'45,444,'57,532,'69,829. E'54,380,'59,403. F254,281. Syn. of Passe Colmar.									
Colmar Reul. Pr101. Syn. of Passe Colmar									
Colmars. Pr99. Syn. of Colmar									
Colmar Sabine. K'32,192. MagofH'37,48,'43,130. Syn. of Sabine									
Colmar Souveraen. K'32,168,'41,156. AgR'54,243. Syn. of Diel									
Colmar Souveraine. Pr213. GenF'33,197. D'45,444,'57,532,'69,829. E'54,380,'59,403. F254. T'85,307,'97,698. Syn. of Passe Colmar.									
Colmart. C200. Th186. H143. Syn. Manna		obtp	l	gy	bdm	s		vl	An old variety resembling Bon Chretien (Win.).
Colmart. Pr99. Syn. of Colmar									
Colmar Van Mons. K'32,192,'41,160. IndF'40,183. IllH'69,240.		p	m	y	b	s		vl	Said to keep for two years.
Colmar Van Mons. D'69,725. Syn. of Invalides									
Colmar Van Mons. E'54,380,'59,403. IllH'63,22. Syn. of Passe Colmar									
Colmar Van Mons (erroneously). D'57,550,'69,864. E'59,352. Syn. of Surpasse Virgalieu.									
Colniac Bosc. E'59,330. Syn. of Anjou									
Coloma. L. CanExFR'01,546. Syns. Beurre Coloma, Beurre du Coloma, Capucine d'Automne Coloma, La Coloma.		ovp	sm	gyr	jm	a	g	m	
Coloma (Conq.). R. Syn. Conquete de Coloma									Published in Magazine of Horticulture, 1843, p. 131.
Coloma d'Automne. D'69,871. Syn. of Urbaniste									
Col. Wilder. MassH'75,119,'77,79. A'81,23. MoH'83,170. McP'91,114. JB'93. IllH'96,178. MichSB27. EFABC'00. AHM268. Syns. Colonel Wilder, Wilder.	Cal.	robtp	ml	yrru	cojm	sp		l	Originated with B. S. Fox, of San Jose, Cal.
Colonel Wilder. Dap146. T'85,558,'97,698. WnI,330,II,340. CNC'93. Syn. of Col. Wilder.									
Coloree d'Aout. MagofH'54,235. Hort'61,219. D'69,717. Syn. of Summer Certeau.									
Coloree de Juillet. D'69,725. EFABC'00. Syn. of Juillet									
Coltin. F279	For.								Published by Field; not described.
Columbe d'Hiver. MassH'46,151									Exhibited by Robert Manning in 1846.
Columbia. K'41,159. D'45,430,'57,482,'69,725. Hort'47,148. Cult'48,55. Cole171. B'51 309, '83, 375. HovI,20. Wg69. E'54,319'59,373. AgR'54,245. H144. F198. A'62,66. Hof. Hort'74,148. T'75,291,'85, 309,'97,482. AHM240. Syns. Columbian, Columbia Virgalouse, Columbian Virgalieu.	N. Y.	obo	l	gy	bgj	sp	g	l	Originated in Westchester County, New York, 1835.
Columbia. IllH'98,180. FDNCo'01. SBro. Syn. of Barseck									
Columbian. MassH'44,51. Syn. of Columbia									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Columbian Virgalieu. D'45,430,'57,482,'69, 725. Cult'48, 55. E'54,319,'59,373. Hof. A'62,66. T'97,698. Syn. of Columbia.									
Columbia Virgalouse. MagofH'43,252. D'45,430,'57,482,'69,725. HovH,17. E'54, 319,'59,373. Hof. T'85,309. Syn of Columbia.									
Columbus. R. Syn. Columbus d'Hiver									Not described. Discarded by Congress of Fruit Growers in 1854.
Columbus d'Hiver. A'51,238. Syn. of Columbus									
Combrone. L. Syn. Glory of Combrone	For?	oblp	ml	ybru	gbmj	s	vg b	me	
Comet. GarM'85,144. A'85,108. OH'85,175,'87,164. IllH'86,180. MoH'87,96,'92, 40. HAJ'88,18. Bl227. GaH'92,42. WnI,335,II,258. T'97,707. EFABC'00. IndH'03,260. Syn. of Lawson.									
Comice. S91. MichH'86,420. NYC'90. E&B'94. T'97,458. Bull6,8. AHM 239. Syns. Beurre Robert, Doyenne de Comice, Doyenne du Comice, Doyenne du Comice (of Angers).	Fr	robtp	l	gyru	dmbj	sp	vg-b	ml	Of comparatively recent introduction.
Comice de Toulon. D'57,537. Syn. of Pound									
Comice de Toulon. F220,283. D'69,875. T'97,698. Syn. of Vicar									
Comice (Fondante). L. Syns. Fondante du Comice, Fondante du Comice Angers.	Fr	ovp	l	yru	jb	sv	g-vg	ml	Originated at Angers, France, about 1849.
Comice panache. R. Syn. Doyenne du Comice panache									In experimental orchard at Agassiz, B. C.
Comice Sweet. L. Syn. Sucree du Comice	Fr		m	ygru	d	s		m	Described by Horticultural Society of Angers.
Commissaire Delmotte. MagofH'57,155,259,'60,19. D'69,726. Syn. of Delmotte									
Commodore. MagofH'42,60 D54',372,'57,570, B'51,315. E'54,393,'59,420. F279. T'75,543,'85,558,'97,698. Syn. Van Mons No. 1218.	Belg	obo	m	yr	cojm	s	g	m	Probably originated by Dr. John Van Mons.
Commodore. H144. D'69,723. T'85,558. Syn. of Colmar									
Commodore Perry. BBL									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Common Bergamot Pr71. K'32,133. GenF'33,196,'37,277. D'45,366,'57,565,'69,663. Syn. of Bergamot (Aut.)									
Common Doyenne. F224. Syn. of White Doyenne									
Communaute. D'69,815. Syn. of Messire									
Compagnie d'Ostende. D'69,858. Syn. of Spanish									
Comperette. E'59,420. A'75,68. Dap155. Syn. of Ananas									
Compete de Fresnel. MagofH'50,295. Cult'50,45. Syn. of Fresnel									
Comprette. MassH'44,59. D'45,371,'57,570'69,726. Hort'47,174. E'54,393. H144. F'279. T'75,543,'85,558,'97,698.	Fl	obtp	s	yg	b	sp	p	m	Said to be of little value.
Compte de Flanders. AHortA'68,79. Syn. of Flandre									
Compte de Lamy. D'45,371. E'54,360,'59,373. F278. Syn. of Lamy									
Compte de Michaux. D'45,398'57,578. E'54,397,'59,423. Syn. of Michaux									
Compte de Paris. MassH'51,189									Not described; possibly the same as Paris.
Comptesse Clara Frys. FGAofO'83,72. Syn. of Frys									
Comptesse de Lunay. D'69,701. T'85,555. Syn. of Montigny									

Comstock. D'45,432,'57,570,'69,727. E'54,393,'59,420. H144. F272. T'75,543,'85,558,'97,698. Syns. Comstock's Seedling, Comstock Wilding.	N. Y	obo	m	yb	co	s	......	m	Originated in Dutchess County, New York.
Comstock's Seedling. MagofH'44,396. MassH'44,64. Syn. of Comstock									
Comstock Wilding. D'45,432,'57,570,'69,727. E'54,393,'59,420. Syn. of Comstock									
Comte de Chambord. EFABC'00. Syn. of Chambord									
Comte d'Egmont. D'69,726. Syn. of Egmont									
Comte de Flanders. AgR'54,245. Syn. of Flandre									
Comte de Flandre. MassH'53,19. Hort'54,82. AgR'56,330. Cult'58,83. D'57,483,'69,727. E'59,374. CGenXI,62. T'75,261,'85,279,'97,458. B'83,379. GarM'87,46. EFABC'00. Syn. of Flandre.									
Comte de Fresnel. K'41,130. A'54,238. Syn. of Fresnel									
Comte de Lacepede. MagofH'55,146. Syn. of Lacepede									
Comte de Lambertye. EFABC'00. Syn. of Lambertye									
Comte de Lamy. GenF'33,196. Cult'39,66. K'41,141. MagofH'42,66,'50,498. Cole163. NAPC'49,38. B'51,304. Wg69. E'54,360. D'57,483,'69,727. H143. T'75,272,'85,290,'97,468. EFABC'00. Syn. of Lamy.									
Comte de Limoges. D'69,668. Syn. of Dumas									
Comte de Meladore. MassH'71,40		p	m	yr	j	v			Resembles Langlier.
Comte de Michaux. K'41,168. E'54,397. F281. D'69,816. Syn. of Michaux									
Comte de Morny. MassH'71,40		ap	m	ym	j	sv	g	......	Reported by Committee of Massachusetts Horticultural Society, 1871, p. 40.
Comte de Paris. MagofH'52,39,'54,86. MassH'53,21. D'57,483,'69,727. T'75,261'85,279,'97,458. Syn. of Paris.									
Comte Lamy. F278. D'69,727. Syn. of Lamy									
Comte Lelieur. D'57,483,'69,727. E'59,373. AJofHV,246. GarM'72,27. T'75,543,'85,558,'97,699. EFABC'00. Syn. of Lelieur (Comte).									
Comte of Flanders. F278. Hort'67,9. Syn. of Flandre									
Comte of Paris. F278. Syn. of Paris									
Comtesse Alost. L. Syn. Comtesse d'Alost	Belg	oblp	l	yrub	jm	va	g-p	m	
Comtesse d'Alost. D'57,482. F279. E'59,372,379. T'75,543,'85,558,'97,699. Syn. of Alost.									
Comtesse d'Alost. AgR'54,243,'56,330. D'69,728. Syn. of Comtesse Alost									
Comtesse de Chambord. D'69,728. Syn. of Chambord									
Comtesse de Frenold. D'45,388,'57,495,'69,760. E'54,367,'59,382. F280. Syn. of Naples.									
Comtesse de Lumay. D'69,749. Syn. of Mars									
Comtesse de Lunay. MagofH'46,144. E'54,359,'59,374. H145. F279. B'83,379. Syn. of Mars.									
Comtesse de Tervueren. D'69,835. Syn. of Pound									
Conference. MichSB30. MichB205. AofH'91,296,'92,276. IllH'97,213. EFABC'00.	......	obtp	ml	gyru	jm	s	vg	......	Promising; not fully tested at Michigan Experiment Station.
Confessels Birne. MHSC'82,58. FGAofO'83,222	Rus?								Very hardy; chiefly used for drying.
Congrès Pomologique. D'69,728. Syn. of Pomologie									
Conkleton. JVL'01,'02	Tex.								New, from Texas. A seedling of Le Conte.
Conklin. D'69,728. Syn. Conklin's Hybrid	N. Y	obtp	ml	gyru	cojm	s	g	me	Originated in Westchester County, New York.
Conklin's Hybrid. GarM'86,365. Syn. of Conklin									
Connecticut. F272. Syn. Dr. Hunt's Connecticut	Conn	ob	m	gy	......	......	p	......	Dr. Hunt, of Northampton, Mass., received it from Connecticut.
Conprie. R. Syn. President Conprie	Fr.								A French variety on trial in Iowa.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Conquete de Coloma. MagofH'43,131. Syn. of Coloma (Conq.)									
Conseiller de la Cour. MagofH'54,458,'55,186,'57,500. Hort'54,418. D'57,483,'69,811. AgR'56,405,'63,124. F278. E'59,400. A'62,66. AHortA'70,77. AJofHV,67. MichH'74,28. B'83,372. WnI,333,II,342. T'75,261,'85,279,'97,458. EFABC'00. Syn of Marechal.									
Conseilleur Ramiez. MassH'51,189. MagofH'52,39. Syn. of Ranwez									
Conseiller Ramuez. Hort'53,30. E'54,359,'59,374. H144. Syn. of Ranwez									
Conseiller Ranwez. D'57,484,'69,728. F279. E'59,374. T'75,543,'85,558,'97,699. Syn. of Ranwez.									
Conseiller Ranweze. F279. Syn. of Ranwez									
Conseilleur Ranwez. AgR'56,331. Syn. of Ranwez									
Consellier Ranwez, Hort'59,32. Syn. of Ranwez									
Consort. L. Syn. Huyshe's Prince Consort	Eng	oblp	l	gru	cojm	sv		m	Raised by Rev. J. Huyshe, Devon, England.
Constante Lesueur. EFABC'00. Syn. of Lesueur									
Cooke. D'57,484. F272. E'59,372. T'75,543,'85,558,'97,699	Va	p	l	y	jb	v		m	Originated in King George County, Va. Introduced by H. R. Roby.
Cooper. R. Syn. Cooper's Early									Exhibited at World's Columbian Exposition by Illinois Horticultural Society, 1893.
Cooper's Early. IllH'93,76. Syn. of Cooper									
Cooper Fall. R. Syn. Cooper's Fall									Published by M'Mahon, in Gardener's Calendar, 1806.
Cooper's Fall. GarCal587. Syn. of Cooper Fall									
Copaca. MassH'47,69,90. MagofH'48,84. Syn. of Copia									
Copea. MassH'45,89. D'45,373. MagofH'50,295. Cult'50,45. A'54,239. E'54,393,'59,420. Syn. of Copia.									
Copia. Hort.'53,534. D'57,571,'69,729. F272. T'75,543,'85,558,'97,699. Syns. Copaca, Copea.	Pa		l	y	co	s	p	m	Originated at Philadelphia, Pa.
Cops Heat. F279. D'69,714. Syn. of Capsheaf									
Coquillarde. Pr29. Syn. of Sapin									
Corail. MagofH'51,472. D'57,500,'69,765. Syn. of Forelle									
Corchorus. D'69,813. Syn. of Marie Louise									
Cordelier. Pr149. D'69,835. Syn. of Pound									
Coreless. AofH'90,173. BBL									Introduced by Bayless in 1890. See Annals of Horticulture, 1890, p. 173.
Corinne. L. Syn. Sucree de Corinne	For								Not described by Field, p. 282.
Corneal. R. Syn. Corneal's Winter (of Kentucky									Cultivated by Silas Wharton in 1824.
Corneal's Winter (of Kentucky). SW. Syn. of Corneal									
Corneau. R. Syn. Doyenne Madame Corneau									In experimental orchard at Agassiz, B. C.

Corneille. R. Syn. Pierre Corneille									In experimental orchard at Agassiz, B. C.
Cornelia. F279	For.								Not described.
Cornelis. MassH'53,21. MagofH'54,86. D'57,488. E'59,375. A'62,118. AHortA-'68,71,80. AJofHIV,191. T'75,543,'85,558,'97,699. Syn. Desire Cornelis.	Belg.	o lp	ml	gyru	jm	s	vg	me	Raised by M. Bivort.
Cornelius Cooter. A'58,196. Syn. of Coter									
Cornwallis. R. Syn. Lord Cornwallis	Can.								Originated at Cornwallis, Canada. Perhaps Ontario.
Cornwell. A'58,59. MagofH'60,64. D'69,729. Syn. Cluster.		r	s	gyru	j	va	g	me	Downing thought it of uncertain identity.
Cotelain. L. Syn. Gros Cotelain	For.								Not described by Field on p. 280.
Coter. MagofH'46,159,'47,64. E'54,360,'59,375. D'57,484,'69,729. F279. T'75,292,'85,310,'97,482. Syn. Cornelius Cooter.	Belg.	obtp	ms	yru	j	v	g	l	Originated by Dr. John Van Mons, of Louvain.
Cotillard de Livre. D'69,716. Syn. of Catillac									
Coule Soif. D'69,863. Syn. of Franc Real (Sum.)									
Coule Soif d'Automne. D'69,804. Syn. of Long Green (Aut.)									
Coulis. D'69,815. Syn. of Messire									
Coulon de Saint Marc. F279. D'69,668. Syn. of Thouars									
Count. MdH'00,59									S. E. Matthews, of Pocomoke, Md., says this is Le Conte.
Count Coloma. D'57,445,'69,871. F222,283. T'75,543,'85,558,'97,699. Syn. of Urbaniste.									
Countess Clara Fays. CanExFR'96,135. Syn. of Fays									
Countess of Lunay. E'54,359,'59,374. T'75,261,'85,279,'97,459. Syn. of Mars									
Count Lelieur. F278	For.								Not described.
Cour. R. Syn. Beurre de la Cour									For sale at Chestnut Hill Nurseries, Philadelphia, Pa.
Courbe. L. Syns. Amiral, Arbre Courbe, Colmar Charnay		ovp	ml	gyru	bmj	a	g	ml	
Courcelles. R. Syn. Henri Courcelles									In experimental orchard at Agassiz, B. C.
Courland Bergamot. CanH'85,39. Syn. of Sapieganka									
Courte de Ersol. D'69,717. Syn. of Summer Certeau									
Courte Queue. L. Syn. Courte Queue d'Automne	Fr.	obrov	m	wyr	bm	svp	vg	m	Originated by Andre Leroy, of Angers, France.
Courte Queue d'Automne. Dap146. Syn. of Courte Queue									
Courtqueue. R. Syn. Courtqueue d'Hiver									In experimental orchard at Agassiz, B. C.
Courtqueue d'Hiver. EFABC'00. Syn. of Courtqueue									
Courtrai. L. Syns. Ananas de Courtrai, Ananas de Courtray, Beurre de Courtrai.	Fr	obtp	l	ybru	j	sp	vg	me	Description by Leroy; probably distinct.
Couvent. D'69,815. Syn. of Messire									
Cowsfoot. EFABC'00									In experimental orchard at Agassiz, B. C.
Craig. OH'85,177. NYC'90. Syns. Butter, Early Butter, Early Butter (of Cincinnati), Early Butter (of Indiana), Early Butter (of Mears), Early Summer Butter, Hastie's Early, Hatch's Early (of the Cin. Hort. Socy.), Mears' Summer Butter, Sanborn Pear, Stanford Pear, Summer Butter, Wright Pear.	Ind.	ovobt	s	gyr	jb	s	g	e	Said to have originated at Vevay, Ind.
Cramoisi. Pr86. Syn. of October									
Cramoisine. MagofH'43,131. Syn. of October									
Cranston. R. Syn. Cranston Seedling									Published in Magazine of Horticulture, 1851, p. 473.
Cranston Seedling. MagofH'51,473. Syn. of Cranston									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Craonnaise. R. Syn. Belle Craonnaise									Exhibited by Col. M. P. Wilder in 1848 as Belle Craonnaise.
Crapaud. F276. D'69,670. Syn. of Bufo									
Crapaudine. Pr34. Syn. of Grise-Bonne									
Crasane. GarCal587. Pr75. Syn. of Crassane									
Crasanne Bergamot. WPr9. Syn. of Crassane									
Crassane. C194. Th186. GenF'33,196. D'45,375,'57,571,'69,729. A'54,238. E'54,393,'59,420. H146. F279. T'75,543,'85,558,'97,699. Syns. Bergamot Crassane, Bergamote Crassanne, Bergamotte Crassane, Bergamotte Crassane d'Automne, Beurre Plat, Beurre Plat or Flat Butter pear, Crasane, Crassane d'Automne, Crassane Bergamot, Crassanne, Crassanne Bergamot, Crassanne Burgamot Cresane, Flat Butter.	Eur	rob	ml	ygr	cojm	s	g	m	Very old; cultivated as early as 1667.
Crassane Althorpe. F279. Syn. of Althorpe									
Crassane (Bergamot). L. Syn. Forme de Bergamotte Crassane	Belg	oblovp	m	yrru	j	a	g	vl	A Van Mons seedling.
Crassane Bergamot (erroneously). IaH'74,46,'76,269,'77,387,'78,264,'79,474,'80,66,507. Syn. of La Motte.									
Crassane Bruneau. F'278. D'69,676. Syn. of Bruneau									
Crassane d'Austrasie. D'69,790. Syn. of Jaminette									
Crassane d'Automne. D'69,729. CanExFR'01,546. Syn. of Crassane									
Crassane d' Ete. D'69,863. Syn. of Crassane (Sum.)									
Crassane d' Ete. D'69,841. Syn. of Red Bergamot									
Crassane d' Hiver. MagofH'48,210. D'57,484,'69,676. F279. T'75,543,'85,558,'97,699. Syn. of Bruneau.									
Crassane d' Hiver de Bruneau. D'69,676. Syn. of Bruneau									
Crassane (Sum.). L. Syns. Crassane d'Ete, Summer Crassane		rob	s	ybru	mj	sp		me	Described by Hogg.
Crassanne. Pr75. K'32,135,'41,122. Cult'39,66. F276. Syn. of Crassane									
Crassanne Bergamot. Pr75. IaH'74,46,'80,66. IndH'98,100. Syn. of Crassane.									
Crassanne Burgamot. SW. IndH'98,101. Syn. of Crassane									
Crassanne Panache. K'41,127. Syns. Crasanne Panachee, Variegated Crasanne									An ornamental variety.
Crassanne Panachee. Pr76. Syn. of Crassanne Panache									
Crawford. M'38,68,'44,53. D'45,335,'57,571,'69,729. E'54,393,'59,420. A'54,238. H145, F279. T'75,543,'85,558,'97,699. Syns. Bancreif, Lammas (of the Scotch).	Scot	obo	m	yb	b	s	g	me	Its chief merit seems to be its hardihood.
Cremesine. Pr19. Syn. of Crimson									
Cremesine d'Aout. Pr19. Syn. of Crimson									
Cresane. Pr75. GenF'33,196. D'45,375,'57,571,'69,729. E'54,393,'59,420. F279. Syn. of Crassane.									
Crimson. Pr19. L. Syns. Cremesine, Cremesine d'Aout, Grosse Cremesine, Large Crimson.	Fr			wgb	cr	vs		me	Probably now obsolete.
Crisco. AgR'93,288. T'97,699. JVL'99,'00 '02	N. C		s				vg	m	A seedling of Seckel. Origin, Richmond County, N. C.
Crispin. L. Syn. Saint Crispin	Mass	oblp	l	gyrru	comj	sa		m	A seedling raised by Israel Buffum, of Lynn, Mass.

Crystalline. Pr79. D'69,660. Syn. of Angelique									
Crocker. YB'05,497. Syn. Crocker Bartlett	Cal								Bartlett seedling. Origin, Loomis, Cal.; first named Crocker Bartlett.
Crocker Bartlett. Circular of L.L.Crocker, Cal.'94. YB'05,498. Syn. of Crocker									
Croft. L. Syn. Croft Castle	Eng		m	gy	jer	s	g p	m	
Croft Castle. K'41,141. MagofH'42,60,'47,154,'50,295. D'45,372,'57,571,'69,729. Cult-'50,45. A'52,113,'54,238. E'54,393,'59,420. H145. F279. T'75,543,'85,558,'97,699. Syn. of Croft.									
Cross. K'41,168. MagofH'41,132,'54,138. D'45,432,'57,481,'69,730. Cole171. E'54,360,'59,375. H145. F272. T'75,294,'85,312,'97,485.	Mass	rob	m	yrru	comj	s	g	l	Originated by Mr. Cross, of Newburyport, Mass.
Crothers. KanH'82,184	Kans.?							ve	Reported from Allen County, Kansas; not described.
Crouch. A'62,211	Conn	obo	m		j	s	vg	e	Exhibited in 1858. Originated in Colchester.
Crow. JSK'98,'01. Syns. Crow's Choice, Isaac Wolson	Tex.?								New; like Bartlett; popular in Grayson County, Texas.
Crow's Choice. NyC'90. Syn. of Crow									
Crustemenie. D'69,884. Syn. of Bon Chretien (Win.)									
Cruy. L. Syn. Due Alfred de Cruy		obtp	l	gyrub	b	p		ml	Described by Hogg as Due Alfred de Cruy.
Cueillette d'Hiver. D'69,875. Syn. of Vicar									
Cuerne. L. Syn. Fondante de Cuerne	Fr	oblp	m	gyrub	jmb	s		me	Description from Annals of Pomology.
Cuillette. F280. Syn. of Jargonelle (Eng.)									
Cuissard. L. Syn. Madame Cuissard	Fr	robtp	m	gy	cojm	sav	g	me	Raised by M. Cuissard, of Ecully, near Lyons.
Cuisse Dame d'Ete. D'69,767. Syn. of Jargonelle (Fr.)									
Cuisse Madame. GenF'37,277. Syns. Epine d'Ete, Fondante Musque, Satin Green, Satin Vert.									Uncertain as to identity; may be distinct.
Cuisse Madame. SW. F280. Syn. of Jargonelle (Eng.)									
Cuisse Madame. C181. Pr154. K'41,119. H136. D'69,767. Syn. of Jargonelle (Fr.)									
Cuisse Madame. Pr155. K'41,118. D'45,347,'57,585. Syn. of Windsor.									
Cuisse Madame (of the French). K'32,133. GenF'37,277. Syn. of Windsor.									
Cully. R. Syn. Belle E. Cully								me	In New Jersey Horticultural Report, 1906, p. 46; not described.
Culotte de Suisse. C192. Pr57. K'32,140,'41,128. F283. D'69,804. Syn. of Long Green (Pear.)									
Cumberland. K'32,168,'41,141. M'38,83,'44,71. MagofH'43,388. MassH'44,59. D'45,375,'57,571,'69,730. E'54,393,'59,420. H146. F272. T'75,544,'85,558,'97,699.	R. I.	obop	l	yr	bj		g	m	A native of Cumberland, R. I.
Cumberland. MagofH'40,508. Syn. of Henkel									
Cumberland (of Belgium). D'69,781. Syn. of Henkel									
Cure. F220,283. Syn. of Vicar									
Cure Carnoy. FGAofO'83,72	For.								Said to be very hardy; being tested in Colorado.
Cure Delmotte. MagofH'57,259									Not described.
Cure d'Oelenghem. F279. Syn. of Oelenghem									
Curette. D'69,875. Syn. of Vicar									
Curran. A'75,97	N. S.								Native of Nova Scotia and promising there.
Curran. D.p152. Syn. of Maria									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Cushing. Pr144. K'32,168 '41,141. MagofH'37,15,'43,370,'50,72. MassH'37,42. GenF'38,85 M'38,71,'44,56,'47,65. Cult'48,87. D'45,373,'57,485,'69,730. Cole159. B'51, 304. Wg69. E'54,360,'59,375. AgR'56,346. H146. F271. T'75,273,'85,291,'97,464. Syn. Hanners.	Mass.	obo	m	gyr	gbm	sp	g	m	Originated at Hingham, Mass., with Colonel Cushing.
Cushman. MassH'66 45.	Mass.								Originated at Brookline, Mass. Fruited in 1865.
Cuvelier. Hort'49,457. MagofH'50,295. Cult'50,45. WHRII,77. E'54,393,'59,420. Syn. Delices Cuvelier.	Eur.	ovp	m	y				m	In experimental orchard, Agassiz, B. C., as Delices Cuvelier.
Cuvellier. MassH'47,69. A'54,238									Exhibited by Robert Manning, September, 1847.
Cyclops. CanH'93,63	Can.	p	l	y	coj	s		l	Originated by Charles Scott, at Elora, Ontario.
Cyprus Pear. Pr20. D'45,343,'57,581,'69,846. E'54,394,'59,421. F282. Syn. of Early Rousselet.									
Cytrymova. Gb. Syn. of Polish Lemon									
Czar. Gb. Syn. Tsarskaya	Rus.								Introduced into the United States in 1879.
Dagobert. D'69,661. Syn. of Angobert									
Dagobert. Pr111. F280. Syn. of Gilogil									
Daimio. GaH'93,54. PJB'94. BBL. Syn. of Daimyo.									
Daimyo. GaH'86,50. Bl229,244. HAJ'88,74. WNYH'88,129. GHM&S'90. MichB31. CanExFR'04,479. AmAg'05,489. Syns. Daimio, Japanese.									A Japanese variety; fit only for the kitchen.
Dalbret. A'62,66. D'69,678. Syn. of Albret									
Dallas. MassH'43,5. MagofH'45,252,'46,146,'47,249,'49,43. A'54,44,155. WHRIV, 450. AgR'54,245. E'54,360,'59,375. D'57,486,'69,730. H146. F271. AJofHVIII, 279,348. T'75,273,'85,291,'97,468.	Conn.	ovp	lm	yb	bj	sp	vg	m	Raised by Governor Edwards at New Haven, Conn.
Dame. FGAofO'91,14. Syns. Griapa, Milepin	Rus.			yr					Resembles Bessemianka.
Dame Houdotte. D'69,657. Syn. of Amadotte.									
Dame Verte. F279	For.								Not described.
Damio. GaH'85,47,49,'90,23,'92,49. LaB22									Probably same as Daimyo.
Damon. R. Syn. Belle Epine Damon									In W. N. White's list of fine varieties for the South.
Dana's Admirable. D'69,655. Syn. of Admirable									
Dana's America. FGAofO'71,30. [Possibly Dana's No. 19.]									
Dana's Excelsior. D'69,759. Syn. of Excelsior									
Dana Hovey. Bul6. Syn. of Danas Hovey									
Danas Hovey. FGAofO'69,44. MichH'99,208,260. Bul8. MichSB27. AHM240. Syns. Dana Hovey, Dana's Hovey, Dana's No 16, Dana's Seedling, Hovey, Hovey Dana's, Winter Seckel.	Mass.	obtp	s	gyru	jm	sp	vg-b	l	Introduced in 1854. The best of the Dana seedlings.
Dana's Hovey. MassH'65,45,76,'66,46,'82,29,'01,96'05,32. AgR'66,134. AHortA'68,80. D'69,730. IndH'71,'36. MichH'74,29,264. T'75,292'85,310,'97,483. B'83,375. OH'87,94. WnI,327,II,337,III,259. Syn. of Danas Hovey.									

Dana's No. 1. D'57,522,'69,814. E'59,397. T'75,551,'85,566,'97,708. Syn. of Martha Ann.									
Dana's No. 3. MagofH'59,207. Syn. of Admirable									
Dana's No. 10. MagofH'60,500. Syn. of Augustus									
Dana's No. 16. MagofH'53,28,108,541,'54,136,'59,202. MassH'56,16,'60,50. CGenIII,11. D'57,486. E'59,375. Syn. of Danas Hovey.									
Dana's No. 17. MagofH'59,209. MassH'82,38. Syn. of Shawmut									
Dana's No. 19. D'57,486. MagofH'59,205. F273. E'59,375. Syn. of America									
Dana's Seedling. MagofH'49,106. Syn. of Danas Hovey									
Dana's Seedling No. 12. MagofH'55,184,'59,204. MassH'56,19. Syn. of Excelsior									
Dana's Seedling No. 19. MagofH'54,137. MassH'56,19. Hort'58,73. Syn. of America									
Dana's Seedling No. 21. MagofH'55,184. [Probably never named and introduced.]									
Danford. R. Syn. Danford Pear									Cultivated by Silas Wharton in 1824.
Danford Pear. SW. Syn. of Danford									
Daniel Leonard. A'62,151. Syn. of Leonard									
Darlmont. Pr200. K'32,168,'41,130	Fl.	obo	m	ru	m	sv		me	Grown at the Horticultural Gardens at Chiswick.
Darlington. D'69,731	Amer.	obtp	l	yru	co	s	g p	me	Inclines to rot at the core.
Dauphin. R. Syn. Grand Dauphin									Published in Magazine of Horticulture, 1843, p. 131.
Dauphine. Pr151. K'32,137,'41,121. D'69,797. Syn. of Lansac									
Davis. MagofH'57,107. Hort'57,110. CGenIX,190. D'69,731. T'75,544,'85,559,'97,699.	Pa	obo	s	y	com	s	g	me	Similar to Elton. Introduced from Delaware County, Pennsylvania.
Davis (Mass.) MassH'66,41	Mass.								Originated by Dr. S. A. Shurtleff, Brookline, Mass. Fruited in 1862.
Davy. NWFG'55,40. Syn of Flemish									
Dazalonia. AgR'56,345. Syn. of Portugal									
D'Abondance. D'45,383. E'54,381,'59,405. Syn. of Mon Dieu									
D'Acele. R. Syn. Marie Louise d'Acele									Published in Magazine of Horticulture, 1857, p. 302.
Deacon Dillen. D'57,490,'69,741. Syn. of Doyen Dillen.									
Deacon Dillon. F279. E'59,377. Syn. of Dillen.									
D'Alencon. K'32,146. Syn. of Hollande									
D'Aloutte. F279	For.								Not described.
D'Amand d'Ete. K'41,130.		p	l	gy	j		g	me	
D'Amande. K'41,130. MagofH'42,250.									Received by Mr. Kenrick from the Horticultural Society of Antwerp.
D'Ambre. D'54,341,'57,578,'69,818. E'54,397,'59,423. F281. Syn. of Muscat Robert.									
D'Amour. Cult'49,66,'50,45. D'45,383,'57,571. A'51,238. E'54,394,'59,420. H147. F276. FFABC'00. Syn. of Mon Dieu.									
D'Ananas. K'41,161. D'45,444. F281. Syn. of Passe Colmar.									
D'Ananas d'Ete. K'41,130. Syn. of Ananas d'Ete.									
Dana. Dapl'53. Syn. of Rogers.									
D'Ananas of some. GenF'33,197. D'57,532. Syn. of Passe Colmar.									
D'Anjou. Bl'28,237. Syn. of Anjou									
D'Anjou (according to Lindley). K'32,143. Syn. of Caissoy									
Dean's. GenF'33,196. D'45,378,'57,436,'69,880. HovII,85. E'51,322,'59,336. F224. T'75,541,'85,559,'97,699. Syn. of White Doyenne									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Dean's Summer. E'54,321. H147. Syn. of Summer Doyenne									
D'Arandore. K'41,148. Syn. of Louise									
Dearborn. K'32,169. E'54,394,'59,420. Syn. Dearborn (of Van Mons)	Belg.								Named by Dr. John Van Mons for Gen. Dearborn. Rejected by Congress of Fruit Growers.
Dearborn. AgR'54,267. S92. Syn. of Dearborn Seedling									
Dearborn (of Van Mons). MagofH'50,295. Cult'50,45. A'51,238. Syn. of Dearborn									
Dearborn Seedling. R. Syns. Dearborn, Dearborn's Seedling, Done's, None's, Wheeler's New St. Michael.	Mass.	rp	ms	y	jm	s	vg	me	Originated in 1818 by Gen. Dearborn, of Roxbury, Mass.
Dearborn's Seedling. K'32,154',41,132. GenF'37,277. M'38,68,'44,53,'47,59. D'45,336,'57,431,'69,732. G83. AgR'50,94,'56,337,'62,182. MassH'48,97. Wg69. A'52,20,'62,66. Hov1,63. E'54,320,'59,336. T'75,255,'85,273,'97,454. Wn1,325,II,335,III,253. Syn. of Dearborn Seedling.									
Dearborn's Sugar. MdH'96,36. [Probably intended for Dearborn Seedling]									
D'Aremberg. K'41,161. Syn. of Glout Morceau									
D'Aremberg Parfait. D'45,123,'57,462,'69,680. Hov1,1. E'54,314,'59,326. F277. AgR'65,188. Syn. of Aremberg.									
D'Auch. Pr94. K'32,143. Syn. of Auch									
D'Auch. GenF'33,196. D'54,434. E'54,393,'59,420. Syn. of Colmar									
D'Austrasie. D'54,438,'57,513,'69,790. E'54,372,'59,392. F281. Syn. of Jaminette									
D'Avril. D'69,664. Syn. of Avril									
De Bavay. B'51,315. MassH'53,18. CGenIII,11			l		m		vg	me	Exhibited as a new variety in 1858.
De Bavay. MagofH'53,542,'55,185. Hort'54,85. AgR'56,356. D'57,486,'69,732. F279. E'59,376. T'75,544,'85,559,'97,699. Syn. of Bavay.									
De Bell Argentine. D'69,716. Syn. of Catillac									
De Bon Crustemenien. D'69,884. Syn. of Bon Chretien (Win.)									
De Bordeaux. GenF'33,197. D'69,700. Syn. of Heri									
De Bouchet. A'75,68. Dap155. Syn. of Ananas									
De Brower. L. Syn. Charlotte De Brower	Belg.	robop	sml	yru	jm	v	g	m	Raised by Maj. Esperen.
De Bur. Pr.112. Syn. of Du Bur									
De Cadet. D'69,670. Syn. of Cadet									
De Cailleau. D'69,863. Syn. of Rose (Sum.)									
De Caillot. D'69,863. Syn. of Rose (Sum.)									
Decain. R. Syn. Decain d'Hiver									Published in Magazine of Horticulture, 1843, p. 131.
Decain d'Hiver. MagofH'43,131. Syn. of Decain									
De Cambron. K'41,130									Published as an outcast by Kenrick, 1841, p. 130.
De Candolle. MagofH'43,131. Syn. Candolle									
Decaye. R. Syn. Vice President Decaye									In experimental orchard at Agassiz, B. C.
De Champagne d'Ete. D'69,717. Syn. of Summer Certeau									

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Dechantsbirne. D'45,378,'57,436,'69,880. F279. AgR'62,183. AofH'91,296. Syn. of White Doyenne.									
De Chine. D'69,658. Syn. of Ambrette									
De Chretien. D'69,884. Syn. of Bon Chretien (Win.)									
De Citrouille. D'69,716. Syn. of Catillac									
De Clion. D'69,875. Syn. of Vicar									
De Coq. F279. D'69,668. Syn. of Brussels									
Decoster. L. Syns. Decoster's Russelet, Rousselet Decoster, Rousselet De Coster	Belg	robop	s	gyrub	cojm	vp	g	me	Raised by Dr. John Van Mons; dedicated to M. Decoster.
Decoster's Russelet. D'69,845. Syn. of Decoster									
De Cure. EFABC'00									In experimental orchard at Agassiz, B. C.
De Cygne. MagofH'43,131									Not described.
De Deux Foix Lane. E'54,393'59,420. D'69,732. Syn. of Deux Foix Lane									
De Deux Ors l'An. F'279. Syn. of Deux Foix Lane									
De Dos. D'69,884. Syn. of Bon Chretien (Win.)									
De Duchesse. D'69,863. Syn. of Bon Chretien (Sum.)									
D'Eau Rose. D'69,863. Syn. of Rose (Sum.)									
D'Esperen. L. Syns. Bergamotte d'Esperen, Bergamotte d'Esperin, Bergamote Esperen, Bezy d'Esperen (erroneously).	Fr	ob	m	gyru	jb	s	g	vl	A seedling of Maj. Esperen; originated in 1830.
Defais. L. T'97,469. Syns. Beurre Audusson d'Hiver, Beurre Defais, Beurre Defays.	Fr	obtp	ml	yru	jm	sp	g	m	
Defays. D'69,743. Syn of Doyenne Defais									
De Fesses. D'69,884. Syn. of Bon Chretien (Win.)									
De Fontenay Vendee. D'69,790. Syn. of Fontenay									
De Graine Damadote. D'69,657. Syn. of Amadotte									
De Grenna. FGAofO'83,72	Eur								On trial in Ontario; proves hardy as far as tried.
De Gros Rateau Raisenette. D'69, 716. Syn. of Catillac									
De Hansel de Morceau. IllH'96,194									On trial at Savoy, Ill., by H. M. Dunlap.
De Henri. D'69,700. Syn. of Heri									
D'Hiver Nouveau. R. Syn. Beurre d'Hiver Nouveau									Resembles Easter Beurre. Published in Magazine of Horticulture, 1857, p. 258.
De Hollande. D'69,886. Syn. of Yat									
De Horticulture. D'69,835. Syn. of Pound									
De Hucket. Pr70. Syn. of Early Bergamot									
De Janvry. D'69,858. Syn. of Spanish									
De Jersey. D'69,805. Syn. of Louise									
De Kienzheim. D'45,347,'57,584,'69,872. E'54,400,'59,425. F283. Syn. of Vallee									
De la Glaciere. D'69,682. Syn. of Capiaumont									
Delahaut. L. Syn. Colmar Delahaut	Belg	rp	m	yru	jm	s	g	ml	Raised by M. Gregoire, of Jodoigne, Belgium.
Delahaye. R. Syn. Vice President Delahaye.		oblp	m	yru	j	v	g	m	In experimental orchard at Agassiz, B. C.
De Lamartine. MagofH'51,235. F279. D'69,797. NYC'90. WNYH'05,140. Syn. of Lamartine.									
De-la-mi-Juillet. D'69,862. Syn. of Archduke									
De la Montieres. D'69,863. Syn. of Rose (Sum.)									
De-la-Motte. DomLncIV.185. GarCal 587 Syn. of La Motte									
Delannoy. L. Syns. Beurre Delannoy, Beurre Dilly, De Launay	Fr	obtp	l	gybru	mj	s	vg	m	Originated by A. Delannoy at Tournai.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
De Lansac. D'69,797. Syn. of Lansac									
De Launay. D'69,684. Syn. of Delannoy									
Delavault. Hort'54,306. D'57,421,'69,666. F276. Syn. of Bartlett									
Delaville. R. Syn. Professor Delaville									In experimental orchard at Agassiz, B. C.
Delaroult de Clement. E'59,324. Syn. of Bartlett									
Delbecq. L. Syns. Beurre Delbecq, Beurre Delberg, Delbecque, Fleur de Mars, Fondante Delbecq.	Belg.	ovobo	m	yr	dmj	s	g	m	
Delbecque. D'69,684. Syn. of Delbecq									
De Lepine. B'51,315. D'57,536,'69,801. F282. Syn. of Lepine									
De Lestumieres. D'69,665. Syn of Barry									
Delfosse. L. Syns. Beurre Delfosse, Beurre Delfosse (Gregoire), Beurre Philippe Delfosse, Bourgmester Delfosse, Bourgmestre (of Boston), Delfosse Bourgmestre, Philippe Delfosse.	Belg.	obtp	ml	gyru	jm	s	g	m	Raised by M. Gregoire, of Jodoigne, Belgium.
Delfosse Bourgmestre. D'69,684. Syn. of Delfosse									
Delices. R. Syns. Forme de Delices, Forme des Delices	Fl.	obo	m	yru	bm	s	g	m	Received from the London Horticultural Society.
Delices Charles. MagofH'40,45. F279. Syn. of Charles Delight, 1st									
Delices Charles Van Mons. E'54,362,'59,376. Syn. of Charles Delight, 1st									
Delices Cuvelier. EFABC'00. Syn. of Cuvelier									
Delices d'Alost. MassH'51,189. D'57,482,'69,724. E'59,372,379. Syn. of Alost									
Delices d'Angers. D'69,733. Syn. of Hardenpont (Ang.)									
Delices d'Ardenpont. GenF'37,277. E'54,361,'59,334. H148. Syn. of Hardenpont (Ang.)									
Delices d'Ardenpont. K'32,169. D'45,384,'69,733. Syn. of Hardenpont (Belg.)									
Delices de Charles. D'57,487,'69,732. E'59,376. Dap155. T'75,544,'85,559,'97,699. Syn. of Charles Delight, 1st									
Delices de Charles. D'69,732. Syn. of Charles Delight, 2d									
Delices de Frogmore. AHortA'68,80. Syn. of Froyennes									
Delices de Froyennes. AJofHI1,46. D'69,733. Syn. of Froyennes.									
Delices d'Hardenpont. GenF'33,196. Cult'39,66. K41,142. B'51,315. E'54,361,'59,334. H148. AgR'54,242. Syn. of Hardenpont (Ang.)									
Delices d'Hardenpont d'Angers. AgR'56,405. A'62,66. MHSC'76,31. Syn. of Hardenpont (Ang.)									
Delices d'Hardenpont de Toulouse. GenF'37,277. Syn. of Hardenpont (Ang.)									
Delices d'Hardenpont du Nord and Belgium. E'54,361,'59,376. Syn. of Hardenpont (Belg.)									
Delices d'Hardenpont (of Angers). MagofH'51,546,'53,103,299. E'54,361,'59,334. D'57,488,'69,733. F279. T'75,273,'85,291,'97,469. Syn. of Hardenpont (Ang.)									
Delices d'Hardenpont (of Belgium). K'32,169,'41,142. Mag.ofH'51,545,550,'53,299. MassH'53,21. D'57,487,'69,733. F238,279. T'75,544,'85,559,'97,699. Syn. of Hardenpont (Belg.)									

Delices de Huy. EFABC'00. Syn. of Huy.									
Delices de Jodoigne. K'41,142. B'51,315. F279. CGenXXV,94. D'69,733. T'75,544, '85,559,'97,699. Syn. of Jodoigne (Delices).									
Delices de la Cacaudiere. MagofH'57,259. D'69,734. AHortA'70,77. Syn. of Cacaudiere.									
Delices de la Meuse. F279. AHortA'69,74. D'69,734. A'71,55. Syn. of Delices Van Mons.									
Delices de Louvenjal. F279. MagofH'60,128. D'69,734. EFABC'00. Syn. of Louvenjal.									
Delices de Mons. F276. Syn. of Devergnies.									
Delices de Mons. MagofH'51,544. E'54,362,'59,376. H148. D'69,734. AHortA'69,74. HAJ'88,74. Syn. of Delices Van Mons.									
Delices des Orphelins. D'69,680. Syn. of Aremberg.									
Delices Dumortier. F279. Syn. of Dumortier.									
Delices Everard. EFABC'00. Syn. of Everard.									
Delices Van Mons. K'41,142. D'69,734. Syns. Delices de la Meuse, Delices de Mons.		ovobp	m	ybru	cojm	sv	g-vg	m	
Delices Van Mons. D'57,558. T'85,311,'97,699. Syn. of Spoelberch									
Delisse. EFABC'00.									Cultivated at Agassiz, B. C.
De Livre. Cult'47,249. EFABC'00.									Cultivated at Agassiz, B. C.
Delmotte. L. Syn. Commissaire Delmotte.	Belg	obtp	m	gyru	jm	s	g	vl	Originated by M. Gregoire.
De Longre. R. Syn. Beurre De Longre.			vl		mb	p		vl	Published by Magazine of Horticulture, 1854, p. 234.
De Louise. D'69,805. Syn. of Louise.									
De Louvain. MagofH'43,137. D'45,383,'57,486,'69,734. E'54,361,'59,375. H147 F279. T'75,544,'85,559,'97,699. Syn. of Louvain.									
De Louvoyan. F279. Syn. of Louvenjal.									
Delpiere. D'69,742. Syn. of Boussock.									
Delpierre. Dup124. Syn. Beurre Delpierre.	Belg	robtp	l	yru	cojm	sv	g-vg	me	An accidental seedling in the garden of M. Delpierre.
Delvigne. L. Syn. Calebasse Delvigne.		p	m	yru	cobjm	ap	g	m	
Deman. L. Syn. Baron Deman de Lennick.	Belg	rob	s	gyru	gjm		g	ml	Too small to be of value.
De Marcenary. MagofH'43,131. Syn. of Marcenary.									
De Manne. GenF'33,196. D'45,434,'57,570,'69,723. E'54,303,'59,420. F279. Syn. of Colmar.									
Demeester. D'69,725. Syn. of Meester.									
De Melon. GenF'33,196. D'45,360,'57,424,'69,686. Hov1,77. E'54,313,'59,327. F277. AgR'62,181. Syn. of Diel.									
Democrat. Hort'58,527. MagofH'59,69. D'69,734. T'75,544,'85,559,'97,700.	Pa	robo	ms	gyru	mj	s	g	me	
Demoiselle. Pres. K'41,122. Syn. of Vigne.									
De Monsieur. D'69,863. Syn. of Rose (Sum.)									
De Monsieur Le Cure. D'69,875. Syn. of Vicar.									
De Montcalm. IllH'96,208.									On trial at Illinois Agricultural Experiment Station.
De Montgeron. D'69,684. Syn. of Montgeron.									
De Montigny. D'69,701. Syn. of Montigny.									
De Mott. D'57,[illegible],'69,820. E'59,410. Syn. of Sterling.									
Dempsey. FGAofO'85,147,'87,10,'89,107,'94,172. CanH'88,244,'91,125,'93,67,'99,143. COHS'91,116. FLondO'94,14,'96,21. BBL. EFABC'00. AHM241. A'95,148.	Can.	oblp	l	ygb	bm	s	vg	ml	A highly prized Canadian (Ontario) variety.
Dempsey 100. EFABC'00. [Probably same as Dempsey]									
De Naples. MagofH'43,130. Syn. of Naples									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
De Navet. BBL.									Being tested by Benjamin Buckman, Farmingdale, Ill.; not described.
Denis. L. Syns. Adele de St. Denis, Saint Denis		t	s	yb	bco	sp		me	Origin unknown.
De Nonne. D'69,681. Syn. of Brignais									
Dentrick. AgR'53,279									Not described.
De Œuf. MagofH'43,131. Syn. of Œuf									
De Pape. F282. Syn. of Saint Pere									
De Perigord. D'69,830. Syn. of Payenche									
De Pretre. MagofH'43,131. Syn. of Preter									
De Pucelle. D'69,790. Syn. of Jalousie (Belg.)									
De Quessoy. D'69,700. Syn. of Caissoy									
De Rachinquin. E'32,170,'41,143. Syn. of Rachinquin									
De Rachois. F193. Syn. of Dumas									
Derouineau. L. Syn. Beurre Derouineau	Fr	obo	s	yru	mj	s	p	m	
De Sainte Catherine. D'69,661. Syn. of Angobert									
De Saint Herblain. F278. D'69,676. Syn. of Bruneau									
De Saint Martin. D'69,884. Syn. of Bon Chretien (Win.)									
De Saint Waast. D'69,702. Syn. of Vaet									
Deschamp. R. Syn. Deschamp's New Late									Discarded by Congress of Fruit Growers, 1849.
Deschamp's New Late. MagofH'50,296. Cult'50,45. A'54,238. Syn. of Deschamp									
Deschamps. GenF'33,196. D'45,423,'57,462,'69,680. Hov1,1. E'54,314,'59,326. F230, 277. AgR'65,188. Syn. of Aremberg.									
Deschasseurs. MagofH'57,512. D'69,735. AHortA'69,73. Syn. of Chasseurs									
Des Dames. D'69,668. Syn. of Brussels									
Des Deux Soeurs. F279. D'69,736. Syn. of Sisters									
Des Esparronais. F212,279. Syn. of Angouleme									
Desfontaines. R. Syn. Bosc Desfontaines									Published in Magazine of Horticulture, 1855, p. 146.
De Sicilie. D'69,841. Syn. of Red Bergamot									
De Sicilie Musquee. D'69,841. Syn. of Red Bergamot									
Desiree Cornelis. Hort'54,420. MagofHort'54,460. D'57,488,'69,735. F279. E'59,375. T'75,543,'85,558,'97,699. AJofHIV,191. HAJ'88,74. Syn. of Cornelis.									
Desire Van Mons. D'69,735	Belg	obtp	ml		mj	s	g	m	A Van Mons seedling originated in 1836.
Desiree Van Mons. D'57,494. F283. E'59,379. MichH'74,28. Syn. of Brabant									
Des Moines. Hort'54,238,239. NWFG'55,127. A'75,154									Confused with Des Nones; perhaps identical.
Des Nones. Hort'52,514. WHRIII,370. E'54,361,'59,376. Syn. of Brignais									

Des Nonnes. WHRIII,370,453. MoH'62,104. OH'74,12									Exhibited at meeting of Ohio Horticultural Society in 1872 by Mr. Fahnestock.
Des Nonnes. D'57,470,'69,681. E'54,361,'59,376. H148. F277. Cult'57,373. CGenX,302. T'75,283,'85,301,'97,475. A'62,66. B'83,366. Syn. of Brignais.									
De Sorlus. Mag of H'52,401. MassH'53,19. E'54,362,'59,376. D'57,488,'69,735. H148. F279. T'75,544,'85,559,'97,700. Syn. of Sorlus.									
De Soulers. D'69,706. Syn. of Soulers.									
De Souris. BBL									Being tested by Benjamin Buckman, Farmingdale, Ill.
De Spoelberg. AgR'54,245. E'54,385. D'57,558,'69,877. T'75,544,'85,559,'97,700. EFABC'00. Syn. of Spoelberch.									
Despoilberg. HovI,13. E'59,412. D'69,877. Syn. of Spoelberch									
Desportes. L. Syns. Dr. Desportes, Madame Henri Desportes, Maurice Desportes.	Fr.	ap	ml	yrru	djm	sp	vg	m	Originated by Andre Leroy, of Angers, France.
Desportes (Andre). L. St. AHM241									Received from Ellwanger & Barry in 1890.
Desportes (Madame). L. Syns. Madame Baptiste Desportes, Madame Desportes.	Fr.	rov	m	ybru	dbjm	sp		m	Originated with Andre Leroy, of Angers, France.
Des Pres. L. Syn. Fondante des Pres	Belg.	obtp	m	yr	bm		g	m	Originated by Dr. John Van Mons.
Des Templirs Blanc. F279. Syn. of White Templirs									
Des Trois Tours. GenF'33,196. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F277. AgR'62,181. Syn. of Diel.									
Des Veterans. D'69,701. Syn. of Veterans									
De Tongres. D'57,488,'69,735. F279. MagofH'60,129. MassH'60,52,'76,94. A'62,111. T'75,261,'85,279,'97,459. B'83,380. WnI,325,II,335. EFABC'00. Syn. of Tongres.									
De Tonneau (of the French). MassH'44,59. D'45,448. Syn. of Tonneau									
De Tout Temps. D'69,716. Syn. of Catillac									
De Torpes. EFABC'00. Syn. of Torpes									
Deutsche National Bergamotte. D'69,778. AofH'91,296. Syn. of Hampden									
Deux Foix Lane. L. Syns. De Deux Foix Lane, De Deux Ors l'An	Eur.	oblp	s	yrru	cod	s	p	me	Small and handsome, but of poor quality.
Deux Soeurs. E'59,376. D'69,736. T'75,544,'85,559,'97,700. Syn. of Sisters									
Deux Tetes. K'32,153,'41,118. Syn. Double Headed									Not described.
Deux tetes. Pr29. Syn. of Two Headed									
De Vallee. GenF'33,197. K'41,134. D'45,347,'57,584,'69,872. E'54,400,'59,425. F283 Syn. of Vallee.									
Devergnies. D'69,736. Syns. Belle du Vernie, Belle du Vernis, Belle Vernie or Vernis, Beurre Duvernay, Delices de Mons, Duvernay, Duvernis, Poire de Duverny.	Belg.	rp	m	ybru	d	s	g	l	Originated at Hainault in 1817
De Vigne Pelone. D'45,388,'57,498,'69,760. E'54,367,'59,382. F280. Syn. of Naples.									
Dewey. BBL. IllH'98,155. Syn. Dewey's Premium									Cultivated by Arthur Bryant, Princeton, Ill.
Dewey's Premium. NebH'91,130. FDNCo'01. BBL. IllH'96,178. EFABC'00. Syn. of Dewey.									
Diel. D'69,791. Syn. of Witte									
Diamant. GenF'33,196. D'45,366,'57,457,'69,769. HovII,77. E'54,369,'59,384. Syn. of Gansel Bergamot.									
Dickerman. D'57,489,'69,736. E'59,376. Syns. Dikeman, Pardee No. 2	Conn.	rob	m	yb	bjm	p	g-vg	m	Raised by S. D. Pardee, New Haven, Conn.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Dickson. NAPC'49,10. Syn. of Gansel Bergamot									
Die Gute Christbirne. Pr59. Syn. of Bon Chretien (Sum.)									
Diel. GenF'33,196. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. H129. AgR'62,181. Hort'75,244,274. T'75,544,'85,559,'97,459. Q15. S92. A'77,85. AHM 241. Syns. Beurre de Gelle, Beurre de Trois Tours, Beurre d'Yelle, Beurre Diel, Beurre Incomparable, Beurre Magnifique, Beurre Melon, Beurre Melon de Kops, Beurre Royale, Beurre Vert, Celeste, Colmar Louverain, De Melon, Des Trois Tours, Diel's Butter, Diel's Butterbirne, Dillen, Dillen d'Hiver, Dillon, Dorothee Royale, Double Phillips, Dry Toren, Florimond, Fourcroy, Fourcroy Bouvier, Fourcroy d'Hiver, Graciote d'Hiver, Gros Dillen, Gros Dillon, Grosse Dorothee, Guillaume de Nassou, La Fourcroy, Mabille, Melon de Kops, Merveille de La Nature, Poire de Melon, Royal, Sylvanche Vert d'Hiver, Sylvanche Verte, Sylvange Verte, Sylvanghe Vert d'Hiver.	Belg	obtp	l	gbm		s	vg	l	Named by Dr. John van Mons for his friend, Doctor Diel.
Diel August. R. Syn. Diel's August		obtp	ml	yru	co		p	m	Cultivated on the experimental farm at Agassiz, B. C.
Diel's August. EFABC'00. CanExFR'01,546. Syn. of Diel August									
Diel's Butter. E'54.313. T'97,700. Syn. of Diel									
Diel's Butterbirne. Pr52. K'32,189,'41,156. GenF'33,196,'37,278. Cult'44,37. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F277. AgR'62,181. Syn. of Diel.									
Diel Panache. R. Syn. Beurre Diel Panache									In experimental orchard at Agassiz, B. C.
Diere. R. Syn. Doyenne Diere									Rejected by Congress of Fruit Growers, 1849.
Die Sommer Christebirne. Pr59. D'45,346,'57,583,'69,863. Syn. of Bon Chretien (Sum.).									
Dieudonne. L. Dieudonne Anthoine	Belg	robtp	m	yrb	mj	svp		m	Description from Annals of Pomology.
Dieudonne Anthoine. D'69,736. Syn. of Dieudonne									
Dikeman. F273. T'75,544 '85,559,'97,700	Conn	obl	m	y	jm	vp		m	This and Dickerman may be identical.
Dikeman. E'59,376. Syn. of Dickerman									
Dillen. Pr200. B'51,315. E'54,362,'59,377. H149. T'97,469. Syns. Dillen d'Automne, Dillon, Deacon Dillon, Doyen Dillon, Doyenne Dillen, Gros Dillen, Marechal Dillen, Marechal Dillon.	Belg	oblp	l-vl	gyru	mbj	s		m	Originated by Dr. John Van Mons.
Dillen. K'32,175. GenF'33,196 D'45,360,'57,424,'69,686. HovI,77. F277. Syn. of Diel.									
Dillen d'Automne. D'69,811. Syn. of Dillen									
Dillen d'Hiver. D'69,686. Syn. of Diel									
Diller. A'52,36,'54,84. WHRHI,264. MagofH'53,67,516,'54,268,'55,198. AgR'54,272. E'54,362,'59,377. Hort'55,191. D'57,490,'69,736. H149. F279. T'75,544,'85,559,'97,700.	Pa	r	s	yru	cogj-m	sp	g-vg	me	
Dillon. F210,277. Syn. of Diel									
Dillon. E'54,362,'59 377. Syn. of Dillen									

Diman. MassH'66,43.	Mass								Fruited in 1863, exhibited in 1866. Originated at Brookline, Mass.
Dingler. K'41,170. MagofH'42,250. D'45,371,'57,483,'69,727. MassH'46,151. E'54, 310,'59,575. F278,279. Syn. of Lamy.									
Directeur Alphand. MassH'93,246. EAB'94,'02. AndN'95. IllH'96,204. T'97,700. WNYH'00,118. EFABC'00. AHM231. Syn. of Alphand.									
Directeur Hardy. EFABC'00.									In experimental orchard at Agassiz, B C.
Directeur Varenne. EFABC'00. Syn. of Varenne.									
Dithmarsh. EFABC'00.									In experimental orchard at Agassiz, B. C.
Dix. Pr142. K'32,160,'41,142. M'38,88,'44,77,'47,81. D'45,378,'57,431,'69,737. MagofH'46,151. MassH'47,41. Colelos. NAPC'49,44. HovI,69. WHRI,165. B'51, 304,'83,380. E'54,323,'59,334. AgR'54,251,'56,367. Wg69. Hof. T'75,262,'85,280, '97,459. WnI,327,II,337.	Mass.	oblp	l	yru	jm	s	vg b	m	Originated in the garden of Mrs. Dix, Boston, Mass., in 1846.
Dixon. NAPC'49,40. Syn. of Gansel Bergamot.									
Doar. WNYH'87,2[illegible]									Reported by George P. Peffer; not described.
Dobbel Amandel (of the Dutch). D'57,466. Syn of Angleterre									
Docteur Bouvier. D'57,493,'69,738. F279. E'59,377. T'75,544,'85,559,'97,700.		robop	m	gyru	cojm	vp	g-vg	l	
Docteur Bretonneau. D'69,176. Syn. of Bretonneau.									
Docteur Caperon. F279. Syn. of Capron.									
Docteur Capron. MagofH'52,299,'53,104. WHRII,559. D'57,493,'69,738. E'59,377. T'75,544,'85,559,'97,700. Syn. of Capron.									
Docteur Koch. MassH'71,41. A'73,99. Hort'75,1. Syn. of Koch.									
Docteur Lentier. D'57,493,'69,738. E'59,377. T'75,544,'85,559,'97,700. MassH'77, 79. Syn. of Lentier.									
Docteur Nelis. MagofH'55,150.									Doubtless same as Doctor Niles.
Docteur Trousseau. MagofH'54,156. Syn. of Trousseau.									
Docteur Trousseau. MagofH'54,235,'57,157,'58,278. D'57,493,'69,738. E'59,377. T'75,544,'85,559,'97,700. Syn. of Trousseau.									
Dr. Bachman. A'67,190,'73,118. Syn. of Bachman.									
Dr. Beult. WNYH'88,129								l	Said to be a meritorious late pear.
Dr. Boal's. IllH'71,152. Syn. of Boal.									
Dr. Bouvier. MagofH'52,90,'55,184. WHRII,559. Hort'61,220			l		m		g	vl	
Dr. Desportes. EFABC'00. Syn. of Desportes.									
Doctor Dillen. D'69,741. Syn. of Doyen Dillen.									
Dr. Gromier. EFABC'00. CanExFR'01,546. Syn. of Gromier.									
Dr. Hoag. IllH'97,213									On trial at Illinois Agricultural Experiment Station.
Dr. Hoskins. IndH'86,82. NYC'90. BBL. Syn. of Hoskins.									
Doctor Howe. Dap125. Syn. of Howe.									
Dr. Hunt's Connecticut. K'32,170,'41,142. Syn. of Connecticut.									
Dr. Jacob. MagofH'51,473. MassH'51,175.									Exhibited by Robert Manning in 1851; perhaps the same as Jacob.
Dr. Jules Guyot. GaH'92,54,'93,54. CanExFR'95,391,'96,446. IllH'96,204. FESofO'98,12. EFABC'00. Syn. of Guyot.									
Doctor Koch. Dap124. GaH'92,49,'93,53. Syn. of Koch.									
Doctor Lenthier. D'69,738. Syn. of Lentier.									
Doctor Lentier. MagofH'57,155,260. F279. A'77,101. MassH'82,24. Syn. of Lentier.									
Dr. Lindley. MassH'71,40. OH'71,48. Hort'72,102,'75,2. B'83,380. Syn. Doctor Lindley.		obop	ms	yru	djm	s	vg	m	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Doctor Lindley. A'71,56. Dap146. B'83,380. Syn. of Dr. Lindley									
Dr. Lucien. EFABC'00. Syn. of Lucius									
Dr. Lucius. OH'87,95. CanExFR'02,380. Syn. of Lucius									
Doctor Nelis. Hort'61,219. D'69,738. AHortA'71,72. AgR'75,381. MichH'75,89. WNYH'76,19.	Belg	robtp	m	gyrru	jm	sv	vg	me	Originated in 1847 and named for Dr. Nelis.
Doctor Reeder. D'69,739. T'75,544,'85,559,'97,700. CanH'79,15,159. FGAofO'82,50. B'83,368. AHM260. Syn. of Reeder.									
Dr. Reeder. Hort'69,10,'72,102. AHortA'69,77. A'69,100. AgR'75,378. FGAofO'78,48. CanH'81,92. WnI,335,II,342. Syn. of Reeder.									
Doctor Turner. A'62,210. D'69,740. AJofHVIII,171. Syn. of Turner									
Dr. Udale's Warden. E'54,334. D'69,835. Syn. of Pound									
Dolgokrostka Morosovskaya. Gb. Syn. of Long Stem									
Dolphin. K'32,137. Syn. of Lansac									
Domville. MagofH'43,131. Syn. of Donville									
Done's. E'59,336. Syn. of Dearborn Seedling									
Donville. Pr.85. Syn. of Provence									
Donville. K'41,125. Syn. Domville		obl		yr	b	a		vl	Described by Duhamel and Rozier.
Dorchester. R. Syns. Clapp's No. 4, Dorchester Beauty	Mass								Raised by Theodore Clapp; shown at meeting of Massachusetts Horticultural Society, 1860.
Dorchester Beauty. MassH'60 50. A'60,122. Syn. of Dorchester									
Dorchester Seedling. MagofH'58,509. Syn. of Sheppard									
Dorothee. L. Syn. Dorothee Royale Nouvelle		p	m	yru	dmj	v		m	Description from Hogg.
Dorothee Royale. K'32,189,'41,156. GenF'33,196,'37,278. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F210. AgR'61,181. Syn. of Diel.									
Dorothee Royale Nouvelle. D'69,740. Syn. of Dorothee									
Dorr. Cole154. E'54,394,'59,421. F273	N. H.	obtp	l	yr	cod	s		me	Fruit very handsome; tree hardy and vigorous.
Dorr. Hort'52,482. Syn. of Jargonelle (Fr.)									
Dorset. IllH'96,178. FESofO'98,122. WNYH'00,118. SBros. E&B'02. Syn. Dorsett.									Cultivated by Ellwanger & Barry.
Dorsett. IllH'96,209,'02,220. Syn. of Dorset									
Dorson. Hort'66,334. Syn. of Dorsoris									
Dorsoris. Hort'67,17,88. AHortA'68,80. D'69,740. A'69,100,'73,61. Syns. American Beauty, Dorson.		rp	m	yb	b	s	g	me	Introduced by Isaac Coles, Glen Cove, Long Island, N. Y.
Double. R. Syns. Double Autumnal, Double d'Automne		r	m		j	p	g	m	An old variety described by Lindley.
Double Autumnal. Pr195. Syn. of Double									
Double Beurre. Gb. CanExFR'96,136. EFABC'00. Syns. Maslitchdvoinaya, Maslitchnaya dvoinaya.	Rus.?								Introduced from Russia by Charles Gibb in 1879.
Double Calice. Pr29. Syn. of Two Headed									
Double d'Automne. Pr195. K'32,171. MagofH'43,131. Syn. of Double									

Double Emplol. MassH'46,151									Exhibited by Robert Manning at meeting of Massachusetts Horticultural Society, 1846, p. 151.
Double Eye. L. Syns. Double Eyed Pear, Poire a deux yeux	Fr.				m	a		e	Said to resemble Jargonelle (Fr.).
Double Eyed Pear. Pr18. MagofH'37,48. Syn. of Double Eye									
Double Fleur. Pr107. K'32,152,'41,125,128. Syn. of Double Flower									
Double Fleur (Panache). K'41,128. Syn. Double Flowering with Striped Fruit.								vl	An ornamental variety with double flowers.
Double Flower. R. Syns. Armenian, Armenie, Double Fleur, Double Flowering, The Double Flower.									Chiefly ornamental; fruit fit only for cooking.
Double Flowering. WPr12. Pr107. Syn. of Double Flower									
Double Flowering with Striped Fruit. Pr108. Syn. of Double Fleur (panache)									
Double Headed. K'32,153,'41,118. Syn. of Deux Tetes									
Double Headed. Pr29. Syn. of Two Headed									
Double Mansuette. D'69,661. Syn. of Angobert									
Double Philips. MagofH'43,125. Syn. of Boussock									
Double Philips. GenF'33,196. Syn. of Diel									
Double Philippe. MagofH'55,188. D'57,433,'69,742. F200,279. E'59,334. AgR'62, 182. T'75,544,'85,559,'97,700. Syn. of Boussock.									
Doullard. F279. D'69,656. T'75,544,'85,559,'97,700. EFABC'00. Syn. Alexandrine Doullard.	Belg	obop	l	yru	jm	v	vg	m	
Dow. D'57,440,'69,741. F273. A'58,92. E'59,377. T'75,544,'85,559,'97,700.	Conn.	obop	ml	ygru	bjm	va	g	m	Raised by Dr. Eli Ives, of New Haven, Conn..
Dowler. R. Syn. Dowler's Seedling									Published in Magazine of Horticulture, 1838, p. 192, as Dowler's Seedling.
Dowler's Seedling. MagofH'38,192,'43,125. Syn. of Dowler									
Doulin. Hort'56,35. D'57,554,69,872. E'59,412. T'75,545,'85,559,'97,700. Syn. of Uwchlan.									
Downham Seedling. GenF'33,197. D'45,395,'57,505,'69,777. E'54,370,'59,386. Syn. of Hacon.									
Downing. NYC'90. T'97,469. Syn. Doyenne Downing	Fr.	obtp	m	gyru	dbjm	svp	g-vg	m	Raised by Andre Leroy and dedicated to A. J. Downing.
Downton. GenF'33,196. Cult'39,66. K'41,160. MassH'44,60. MagofH'50,296. A'51, 238. E'54,394,'59,420. HMH82,39.	Eng.	p	m	yb				l	Originated by Dr. Andrew Knight, of England.
Doyen Dillen. MassH'53,18. D'57,490,69,741. Syns. Deacon Dillen, Doctor Dillen, Doyenne Dillen.	Belg	oblp	lm	yru	jb	s	vg	m	First exhibited at meeting of Massachusetts Horticultural Society, 1853, p. 18.
Doyen Dillon. MagofH'52,402. F279. Hort'64,181. EFABC'00. Syn. of Dillen									
Doyenne. Th192. Pr43. K'32,152,'41,121. D'45,378,'57,436,'69,880. E'54,322,'59,336. FESofO'04,51. Syn. of White Doyenne.									
Doyenne Anna Audisson. D'69,661. Syn. of Audisson									
Doyenne Barry. D'69,665. Syn. of Barry									
Doyenne Beurre. HIH'68,311. [Identity uncertain]									
Doyenne Blanc. GenF'33,196. Cult'44,36. K'41,121. D'45,378,'57,436,'69,880. HovH.87. A'52,93. E'54,322,'59,336. AgR'51,242,'62,183. F221,279. T'75,545,'85,559. Syn. of White Doyenne.									
Doyenne Boisnard. EFABC'00. Syn. of Boisnard									
Doyenne Boisselot. EFABC'00. Syn. of Boisselot									
Doyenne Bon Lock. IHH'82,237.									Discussed in Illinois Horticultural Society at Alton, Ill.; possibly a misprint.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Doyenne Boussock. MagofH'47,68,'51,42,'55,187. B'51,304,'83,369. HovI,31. Wg-69. AgR'56,330,'62,182. D'57,433,'69,742. F200. MoH'64,31. IaH'71,69. Hort-'72,55,126. T'75,545,85,559. MVHS'83,129. WnI,326,II,336. Syn. of Boussock.									
Doyenne Boussock Nouvelle. HovI,31. AgR'62,182. D'69,742. T'75,545,'85,559. Syn. of Boussock.									
Doyenne Boussouck. MagofH'47,68,'51,42,'55,187. AgR'50,95. HovI,31 Cult'51, 210. A'54,137,'62,68. E'54,318,'59,334. F279. IllH'71,152. B'83,368. Syn. of Boussock.									
Doyenne Boussouck Nouvelle. K'41,143. HovI,31. E'54,318,'59,334. D'57,433. T'85,289,559. Syn. of Boussock.									
Doyenne Boussouck (of some). D'45,380,'57,437,'69,745. Cole167. Syn. of Gray Doyenne.									
Doyenne Broussack (of some French collections). HovI,31. Syn. of Boussock									
Doyenne Caroline. K'41,170. MagofH'42,250.									Listed as a promising new variety by Kenrick.
Doyenne Crottee. MassH'47,69. D'69,859. Syn. of Stevens.									
Doyenne Cuvert. F279. Syn. of Gray Doyenne.									
Doyenne d'Affay. E'59,378. D'69,743. Syn. of Doyenne Defais.									
Doyenne d'Alencon. Cult'47,340. B'51,309,'83,375. E'54,321,'59,335. Hort'56,347. AgR'56,105,'66,133. D'57,434,'69,742. H150. F241. MagofH'57,397. HHH'69,135. T'75,292,'85,310. MVHS'83,130. WnI,527,II,337. Syn. of Alencon.									
Doyenne d'Automne. Pr46. K'32,136. GenF'33,196,'37,277. D'45,380,'57,437,'69, 715. E'54,322,'59,335. F245. AgR'64,142. Syn. of Gray Doyenne.									
Doyenne de Bruxelles (erroneously). D'69,712. Syn. of Caen.									
Doyenne de Cercle. D'69,712. HHH'69,156. AHortA'70,77. Syn. Doyenne de Cercle Pratique de Rouen.	Fr	rp	m	gyru	jm	v	g	m	
Doyenne de Cercle de Practique de Rouen. D'69,742. Syn. of Doyenne de Cercle.									
Doyenne d'Ete. D'45,336,'57,434,'69,742. MagofH'47,66. B'51,300,'83,364. HovI, 59. Wg69. A'52,22,'62,68. AgR'53,279,'54,249,'56,337,'63,124. WHRN163. E'54, 321,'59,334. Hort'53,491. CGenXVII,14. T'75,256,'85,274. Q60. S89. WnI,325,II, 335. Syn. of Summer Doyenne.									
Doyenne Defais. MagofH'52,474,'53,40,'55,270,'57,158. D'57,492,'69,743. E'54,363,'59, 378. H152. F279. T'75,273,'85,291. MHSC'76,31. PaFS'71,66. Syns. Defays, Doyenne d'Affay.	Fr	rob	ms	yrru	jm	sp	g-vg	m	Originated at Angers, France.
Doyenne d'Hiver. E'54,394,'59,420. Syn. of Coffin.									
Doyenne d'Hiver. F277. Syn. of Easter Bergamot									
Doyenne d'Hiver. Pr53. K'32,193,'41,160. GenF'33,198,'37,278. D'45,425,'57,428,'69, 751. E'54,317,'59,336. Hort'54,444. F214,277. AgR'60,180. T'75,545,'85,560,'97, 700. B'83,374. Syn. of Easter Beurre.									
Doyenne d'Hiver d'Alencon. D'57,434,'69,742. F279. AgR'66,133. E'59,335. T'75, 545,'85,560. B'83,375. Syn. of Alencon.									
Doyenne d'Hiver de Bruxelles. K'41,160. Syn. of Easter Beurre.									

Doyenne d'Hiver Nouveau. Cult'47,340. B'51,309. D'57,434,'69,742. F279. A'62,68. T'75,545,'85,560. Syn. of Alencon.								
Doyenne d'Hiver. Fr151. Syn. of Sieulle								
Doyenne de Juillet. Hov1,59. D'57,434,'69,742. E'59,334. A'62,68. AgR'63,124. Syn. of Summer Doyenne.								
Doyenne de Merode. D'69,742. Syn. of Boussock								
Doyenne de Montjean. EFABC'00. Syn. of Montjean								
Doyenne de Printemps. K'41,160. Syn. of Easter Beurre								
Doyenne de Saumur. D'69,743. Syn. of Saumur								
Doyenne Diere. MagofH'50,296. Cult'50,45. Syn. of Diere								
Doyenne Dillen. B'51,315. E'54,362,'59,377. Syn. of Dillen								
Doyenne Dillon. AgR'58,597. T'75,273,'85,291. Syn. of Doyen Dillen								
Doyenne Dore. A'54,238								Rejected by Congress of Fruit Growers, 1849; not described.
Doyenne Downing. MagofH'54,235,'59,504. E'54,378. D'57,492,'69,744. F279. MassH'73,97. T'75,275,'85,291. Syn. of Downing.								
Doyenne du Comice. MagofH'51,552,'52,168. E'54,363,'59,378. H151. A'62,68,'64,59,'75,68. Hort'64,54. AHortA'70,77. AJofHV54. D'69,744. IllH'71,45. T'75,282,'85,289. B'83,368. MassH'81,39,'82,37. WnI,327,II,337,III,259. Syn. of Comice.								
Doyenne du Comice (of Angers). Hort'51,504. E'54,363,'59,378. Syn. of Comice								
Doyenne du Comice panache. EFABC'00. Syn. of Comice panache								
Doyenne du Printemps. GenF'33,198. D'45,425,'57,428,'69,751. E'54,317,'59,331. H154. F244. AgR'62,180. Syn. of Easter Beurre.								
Doyenne Flon Aine. EFABC'00. Syn. of Flon Aine								
Doyenne Fondante. F278. Syn. of Orleans								
Doyenne Galeux. D'45,380,'57,437,'69,745. E'54,322,'59,335. F279. AgR'64,142. Syn. of Gray Doyenne.								
Doyenne Gibert. D'69,859. Syn. of Stevens								
Doyenne Galonge. F245. Syn. of Gray Doyenne								
Doyenne Goubalt. E'54,363,'59,378. Hort'53,30. H152. F279. Syn. of Goubault (Doyenne).								
Doyenne Goubault. MagofH'50,491. B'51,315. A'52,26. AgR'56,405. D'57,491,'69,745. HnH'58,22,'60,156. T'75,287,'85,305. Syn. of Goubault (Doyenne).								
Doyenne Gray. GenF'33,196. D'45,380,'69,745. B'51,305,'83,368. Wg69. E'54,322,'59,335. F279. A'62,68. AgR'64,142. Syn. of Gray Doyenne.								
Doyenne Grey. Cult'39 66. AgR'54 257. T'75,275,'85,293. Syn. of Gray Doyenne								
Doyenne Gris. Fr46. K'32,136,'41,122. GenF'33,196,'37,277. Cult'39,66. D'45,380,'57,437,'69,745. Cole167. E'54,322,'59,335. F245. A'62,68. AgR'64,142. T'75,545,'85,560. Syn. of Gray Doyenne.								
Doyenne Gris d'Hiver d'Alencon. F241. Syn. of Alencon								
Doyenne Gris d'Hiver Nouveau. MagofH'47,452. Cult'52,36. E'54,321,'59,335. Hort'57,114. D'57,434,'69,742. H150. F241. AgR'66,133. T'75,545,'85,560. Syn. of Alencon.								
Doyenne Guillard. EFABC'00. Syn. of Guillard								
Doyenne Hovey. D'69,784. Syn. of Hovey								
Doyenne Jamin. WNYH'05,140								Exhibited by Ellwanger & Barry, 1905.
Doyenne Janvier. Hort'72,150,'73,37. Syn. of Janvier								
Doyenne Madame Corneau. EFABC'00. Syn. of Corneau								
Doyenne Madame Th. Levavasseur. EFABC'00. Syn. of Levavasseur								
Doyenne Marbre. E'54,335. D'57,434,'69,742. F279. AgR'66,133. Syn. of Alencon								

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Doy. Meynier. HAJ'88,74. Syn. of Meynier									
Doyenne Mons. MassH'47,69. MagofH'50,296. Cult'50,45. A'54,238									Rejected by Congress of Fruit Growers, 1849.
Doyenne Musque. MagofH'48,198. NAPC'49,38. E'54,355,'59,369. D'57,474,'69,701. F278. T'75,545,'85,560. Syn. of Montigny.									
Doyenne Nerckman. MagofH'47,562. Syn. of Nerckman									
Doyenne Panache. Pr200. K'41,168. B'51,305. E'54,323,'59,336. D'68,881. CGenXXIII,288. Syn. of Striped Doyenne.									
Doyenne Robin. K'32,170,'41,168. MagofH'50,491,'54,83. B'51,315. Wg69. Hort'54,84. E'54, 363,'59,378. H151. F279. MassH'53,18. AgR'56,367. Cult'58,184. A'62,68. CGenXI,254. D'69,746. T'75,284,'85,302. WnI,333,II,342. Syn. of Robin.									
Doyenne Robin (of Langlier). D'57,490. Syn. of Robin									
Doyenne Rose B'51,316. E'54,362,'59,379. D'57,571,'69,746. H151. F279. IllH'69,155. PaFS'71,62. Hort'72,130. T'75,545,'85,560.	Fr	obop	ml	yb	cog		p	m	
Doyenne Rouge. GenF'33,196. D'45,380,'57,437,'69,745. E'54,322,'59,335. T'75,545,'85,560. '97,700. Syn. of Gray Doyenne.									
Doyenne Roux. Pr46. K'32,136,'41,122. GenF'37,277. D'45,380,'57,437,'69,745. E'54,322,'59,335. F245. Syn. of Gray Doyenne.									
Doyenne Royale. MagofH'43,131									Not described.
Doyenne Santelete. Pr201. GenF'37,277. MagofH'43,131,'48,63. Syn. of Santellet									
Doyenne Santellet. K'32,170,'41,130. E'54,363,'59,378. H152. D'69,746. Syn. of Santellet.									
Doyenne Scieulle. WHRI,65. Syn. of Sieulle									
Doyenne Sieulle. MagofH'46,175. B'51,310. HovI,17. E'54,363,'59,378. D'57,435,'69,746. Cult'58,51. H151. F240. CGenXI,28. AgR'65,190. IllH'69,159. T'75,545,'85,560. Syn. of Sieulle.									
Doyenne Soulange. K'41,170. MagofH'42,250. Syn. of Soulange									
Doyenne Sterkmans. MagofH'55,521. D'57,458,'69,698. F277. Syn. of Sterkmans.									
Doyenne White. GenF'33,196. B'51,305,'83,369. E'54,323,'59,336. AgR'54,251,'62,183. A'62,68. D'69,880. IllH'69,54. MVHS'83,130. Syn. of White Doyenne.									
Drapiez. MagofH'43,125. Syn. Drapiez d'Ete									Kenrick says that it is highly spoken of.
Drapiez d'Ete. K'41,168. MagofH'43,125. Syn. of Drapiez									
Dremont. R. Syn. Beurre Dremont	For. ?								Reported as a new foreign variety.
Driesche's Butterbirne. AofH91,296									Not described.
Driessche. L. Syn. Beurre Van Driessche	Belg	obtp	ml	yb	dmjg	sv		vl	Description from Leroy.
Driessen. R. Syn. Beurre Driessen									Published in Magazine of Horticulture, 1855, p. 146, as Beurre Driessen.
Driver? D'69,773. Syn. of Bilboa									
Drone. Pr25. Syns. Bourdon Musquee, Bourdon or Humble bee pear, Musk Drone, Mushy Bourdon, Oranged d'Ete.		rob		g	bj	m		ve	Perhaps obsolete.

Drouard. MichSB27. BulS. AHM241. Syn. President Drouard (of Green)									Received from Charles A. Green, Rochester, N. Y.
Drouet. L. Syns. Bergamote Drouet, Bergamotte Drouet	For.								Published by Field as Bergamote Drouet.
Dry Martin. Pr58. K'32,147,'41,123. D'69,814. Syn. of Sec									
Dry Toren. F277. D'69,686. Syn. of Diel									
Dubison. R. Syn. Beurre Dubison									In experimental orchard at Agassiz, B. C.
Dubossury. A'51,238									Not described.
Du Bouchet. D'69,660. Syn. of Ananas d'Ete									
Du Breuil. L. Syn. Du Breuil Pere	Fr. ?	robp	m	gb	dmj	sv		me	Originated with Alphonse Du Breuil.
Dubreuil. L. Syn. Professor Dubreuil	For.								May be same as Du Breuil.
Du Breuil Pere. D'69,746. Syn. of Du Breuil									
Du Bur. Gen.F'33,197. D'69,669. Syns. Beauty of Winter, Belle Noisette, Bellissime d'Hiver, Bellisime du Bur, De Bur, Teton de Venus, Vermillion d'Hiver des Dames.		obtp	l	gyrru	dco	s		l	Only valued for cooking.
Duc Alfred de Cruy. D'69,747. Syn. of Cruy									
Ducar. L. Syn. Madame Ducar	Belg.	obop	m	yru	jm	v	vg	me	Introduced by Major Esperen.
Duc d'Aremberg. Pr51. K'32,188,'41,136. GenF'33,196,'37,276. D'45,423,'57,462,'69,680. Hov1,1. E'54,314,'59,326. F230. AgR'65,188. B'83,375. Syn. of Aremberg.									
Duc d'Aumale. D'69,747. T'75,545,'85,560,'97,700. Syn. of Aumale									
Duc de Bedford. MagofH'55,146. Syn. of Bedford									
Duc de Bordeaux. K'41,169. Cult'47,340. B'51,315. E'54,344. Syn. of Vicar									
Duc de Bourdeaux. D'57,454,'69,668. F276. E'59,360. A'62,66. MoH'62,104. T'75,545,'85,560,'97,700. B'83,374. Syn. of Dumas.									
Duc de Brabant. MagofH'54,235,461,'57,260. D'57,494,'69,747. F283. E'59,379. MichH'74,28. T'75,263,'85,281,'97,460. A'81,98. MassH'82,24. B'83,380. Syn. of Brabant.									
Duc de Morny. Dap'124. Syn. of Morny									
Duc de Nemours. MagofH'48,111,'50,300. WHRH,560. F279. D'69,695. Syn of Navez.									
Duc d'Orleans. D'57,483. F281. E'59,400. Hort'60,68. AgR'63,124. Dap155. MichH'74,28. Syn. of Marechal.									
Duc d'Orleans. MagofH'51,455,'55,188. E'59,379. D'69,749. Syn. of Orleans.									
Duc de Saxe Weimar. Mag ofH'55,146. Syn. of Weimar									
Duchess. MichH'79,317,'88,120. HH'86,85. Q32. Bl228. Syn.of Angouleme									
Duchesse d'Alost. D'57,482. E'59,372,379. T'75,545,'85,560,'97,700. Syn. of Alost									
Duchesse d'Angouleme. GenF'33,196,'37,277. K'32,171,'41,143. M'38,89,'44,65,'47,69. Cult'39,66. D'45,381,'57,494,'69,747. NAPC'49,8. B'51,304,'83,369. Hov.I'73. Wg69. Ag R'53,279,'54,250. E'54,364,'59,379. NWFG'55,40. A'62,68. S92. HMHS224. T'75,263,'85,281. Wn1,326,11,336,111,258. Syn. of Angouleme.									
Duchesse d'Angouleme Bronze. EFABC'00. Bronze Duchesse									
Duchesse d'Angouleme Variegated. F279. Syn. of Angouleme (Var.)									
Duchesse d'Aremberg. F279. D'69,747. T'85,560. Syn. of Aremberg (Duchesse).									
Duchesse de Berri. K'41,143. MagofH'52,151. E'54,366. H153. MassH'76,93. Syn. of Berri.									
Duchesse de Berri d'Ete. AgR56,405. E'59,379. A'62,68. Hort'64,80. FGAofO'72,13. T'75,257,'85,275,'97,456. Syn. of Berry.									
Duchesse de Berri d'Ete. Cult'47,340. AgR'58,394. OH'63,14. Syn. of Summer Doyenne.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Duchesse de Berry. K'41,143. Cult'47,340. D'69,748. CanExFR'05,430. Syn. of Berry.									
Duchesse de Berry. MassH'51,189. F283. AJofHVI,50. Syn. of Pound									
Duchesse de Berry d'Ete. D'57,493,'69,148. F279. AJofHVIII,224. B'83,364. T'85,275. Syn. of Berry.									
Duchesse de Berry d'Ete (of Bivort). MagofH'54,455. D'57,434. F279. E'59,334. AgR'63,124. Syn. of Summer Doyenne.									
Duchesse de Berry d'Hiver. Cult'47,340. F283. D'69,835. Syn. of Pound									
Duchesse de Berry de Nantes. D'69,748. Syn. of Berry									
Duchesse de Bordeaux. Hort'69,72,190,'70,110. Bul6,8. AHM235. H,B'03,136. Syn. of Bordeaux.									
Duchesse de Bourdeaux. Hort'69,72. IllH'69,136,155. AJofHV,241. D'69,748. AHortA'70,77. OH'71,47. Syn. of Bordeaux.									
Duchesse de Brabant. A'62,68. T'75,545,'85,560. Syn. of Soldat									
Duchesse de Brabant (Capenick). MagofH'57,260. D'69,749. Syn of Brabant (Duchesse Capenick).									
Duchess de Brabant (Durieux). MagofH'57,260. D'57,494'69,748. F279. Syn. of Brabant (Duchesse Durieux).									
Duchesse de Brissac. EFABC'00. Syn of Brissac									
Duchesse d'Hiver. D'69,749. NHF'78,28. OH'88,49. Syn of Winter Duchesse									
Duchesse de Mars. K'32,192,'41,169. GenF'33,196. Cult'39,66. MagofH'45,175. D'45,382,'57,572,'69,749. B'51,316. E'54,366,'59,379. H153. F'279. T'75,'545,85,560. Syn. of Mars.									
Duchesse de Mouchy. AJofHVIII,228. Dap,155. Syn. of Mouchy									
Duchesse d'Orleans. K'41,143. MagofH'46,147. B'51,304,'83,380. HovI,91. Wg70. A'52,22. Hort'53,305. AgR'54,246,'63,125. D'57,493,'69,749. F229. OH'63,11 T'75,263,'85,281. Syn. of Orleans.									
Duchesse Elsa. EFABC'00. Syn. of Elsa									
Duchesse Helene d'Orleans. MasH'62,32. A'62,115. D'69,749. T'75,273,'85,291. Syn. of Helene.									
Duchesse Hybrid. MichB31. BBL									Not described.
Duchesse of Angouleme. Pr126. K'32,171. GenF'37,277. E'54,364. Syn. of Angouleme.									
Duchesse (of Berri). E'54,366. Syn. of Berri									
Duchesse of Mars. K'32,192. E'54,366. Syn. of Mars									
Duchesse of Berry. MagofH'51,438. E'54,366,'59,379. Hort'55,65. Syn. of Berri									
Duchesse of Orleans. E'54,364,'59,331. Syn. of Orleans									
Duchess Precose. Gb. FGAofO'95,33,'99,18. FESofO'98,122. CanH'02,404	Rus?								Introduced into America in 1882.
Duchesse Precoce. AHortA'70,70. A'71,55,'73,76. AgR'75,381. T'75,560. Dap-125. B'83,369. WnI,333,II,342. E&B'94. Syn. of Early Duchess.									
Duchovaya. Gb. Syn. of Scented									

Duchovoi. FGAofO'91,12	Rus		l	y			vg	m	On trial at Ontario, Canada, agricultural stations.
Duck Monarch. F282. Syn. of Ghislain									
Du Colombier. D'[illegible]. Syn. of Red Bergamot									
Du Cure. D'69,875. Syn. of Vicar									
Dudley. MassH'79,168. A'79,96	Mass		ml				vg	m	Originated with Mr. Dudley, of Boston Highlands, Mass.
Duhamel. L. AHM241. Syn. Duhamel du Monçeau	Fr	rp	m	wyb	bjm	sv	vg	m	Raised by Andre Leroy and dedicated to Du Monceau.
Duhamel du Monceau. A'73,76,'81,30. T'75,560,'97,700. Dap146. B'83,376. WNYH-'81,128. IHH'89,75,'90,12[illegible]. Wml,333,II,242. CanExFR'98,200. AHM241. Syn. of Duhamel.									
Duhaume. L. T'97,700. Syn. Beurre Duhaume		obt	m	ru	gjmb	v	g	l	
Duke. R. Syn. Lucy Duke	N. C.	ap	l	gru			vg		Seedling of Winter Nelis and Bartlett.
Duke de Nemours. EFABC'00. Syn. of Nemours									
Dula. Gb. IaB3. Syn. Dula Medviedevka	Rus								Imported in 1879; not described.
Dula Medviedevka. Gb. Syn. of Bear									
Dula Medwedowka. CanExFR'9[illegible],91,'9[illegible],156,1[illegible]. EFABC'00. Syn. of Dula									
Dull Medwedowka. IaH'80,61									Mentioned by Professor Budd; not described.
Dumas. MagofH'[illegible]. F193. D'[illegible]. T'75,263,'85,281,'97,469. Bub. Syns. Belle Epine Dumas, Beurre d'Elbeuf, Beurre de Rochoir, Beurre Rochechourt, Beurre St. Louis, Colmar de Lot, Comte de Limoges, Duc de Bourdeaux, Dumas de Limoges, Dumas de Rochechoualt, Dumas de Rochefort, Du Rachois, Emile de Rochois, Epine de Limoges, Epine de Rochefort, Epine Dumas, Epine du Rochoir, Epine du Rochois.		obtp	m	gyru	bmj	s	vg	l	
Dumas. K'41,[illegible]. D'[illegible]. Hov1,47. E'54,341. AgR'62,189. Syn. of Vicar									
Dumas de Limoges. F193. Syn. of Dumas									
Dumas de Rochechouart. F193. Syn. of Dumas									
Dumas de Rochefort. F193. Syn. of Dumas									
Dumbarton. A'[illegible]. Syn. Dunbarton									Dumbarton doubtless correct.
Dumont. L. Syns. Beurre Dumon, Beurre Dumont	Belg	robtp	ml	yrru	gjm	s	g	m	Raised by Joseph Dumont.
Du Montcalm. IHH'93,126									On trial with T. E. Goodrich, of Cobden, Ill.
Dumont Dumortier. F279. MagofH'59,505. D'69,750	Belg	robo	l	yrru	mj	v	g	m	
[illegible]. F279. D'[illegible]. Syn. of Dumortier									
Dumortier. MagofH'[illegible]. D'45,378,'57,195. E'54,391,'59,421. T'75,273,'85,[illegible]'97,469. Syns. Beurre Dumortier, Delices Dumortier, Dumonstier, Du Mortier.	Belg	robop	m	gru	jm	sv	g vg	m	
Du Mortier. D'69,687. Syn. of Dumortier									
Dumonstier. D'69,687. Syn. of Dumortier									
Dunan. R. Syn. Rene Dunan		obtp	l	yru	coj	s	p	m	In experimental orchard at Agassiz, B. C.
Dunbarton. MagofH'[illegible]. Syn. of Dumbarton									
Duncain. R. Syn. Duncain d'Hiver									Published in Magazine of Horticulture, 1843, p. 131.
Duncain d'Hiver. MagofH'43,131. Syn. of Duncain									
Dundas. MagofH'[illegible],'43,132. D'45,384,'57,189,'69,750. E'54,366,'59,380. H153. F[illegible]. T'[illegible],'85,281,'97,469. Syns. Eliott Dundas, Elliott Dundas, Felicite Dundas, Fortunee, Heliote Dundas, Parmentier, Rousselet de Jamin, Rousselet [illegible], Rousselet Jamin.	Belg	robop	m	yrru	jm	s	g vg		Sent to this country by Dr. John Van Mons, in 1834.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Dunmore. K'41,144. D'45,380,'57,572,'69,750. MagofH'47,154. Cole159. B'51,304. Wg70. WHRI,130. AgR'53,279. E'54,365,'59,380. NWFG'55,40. H153. F279. T'75,273,'85,291,'97,469.	Eng	obl	l	grru	jmg	v	vg	me	Raised by Dr. Thomas Andrew Knight.
Du Patre. D'45,425,'57,428,'69,751. E'54,317,'59,331. F277. AgR'62,180. Syn. of Easter Beurre.									
Du Petit Thouars. MagofH'55,146									Not described.
Dupont. AHM242. Syn. Pennington									Pennington and Dupont perhaps identical.
Du Pradel. D'69,875. Syn. of Vicar									
Dupuy. L. Syn. Dupuy Charles	Belg	ap	ms	yru	jm	s	g	m	Originated by L. E. Berckmans in 1847.
Dupuy Charles. D'57,495,'69,750. F279. E'59,381. T'75,545,'85,560,'97,701. Syn. of Dupuy.									
Duquesne. MassH'44,61. A'54,238. Syns. Beurre Duquesne, Duquesne d'Ete	Eur	obtp	m	g				me	
Duquesne d'Ete. MagofH'39,391,'50,286. K'41,132. Cult'50,45. E'54,394,'59,421. Syn. of Duquesne.									
Durand. L. HHF'96,214. Syn. Beurre Durand	Fr	oblp	m	yrb	dm	sv		m	Originated at Angers; introduced in 1855.
Durandeau. MagofH'60,129. MassH'60,52. AJofHIX,242. T'75,545,'85,560,'97,701. B'83,380. Syn. of Tongres.									
Duree. D'69,751. Syn. Duree's Seedling	N. Y.	oblp	m	yru	mj	vsp	g-vg	m	Tree found on Long Island by Isaac Hicks.
Duree's Seedling. D'69,751. Syn. of Duree									
Durfee. MassH'48,101. Syn. Shawl	R. I								Originated on farm of George Durfee.
Durieux. L. Syns. Madame Durien, Madame Durieux	Fl	obop	ms	yru	bmj	s	vg	m	
Durimont. MagofH'43,131									Not described.
Durondeau. CanExFR'95,391,'96,445. Syn. of Tongres									
Du Seigneur. D'69,762. Syn. of Lucrative									
Dusnas. MagofH'46,295. HovI,71. E'54,380,'59,410. Hort'68,202. D'69,851. Syn. of Archangel.									
Dussart. L. Syns. Bergamote Dussart, Bergamotte Dussart	Belg	obop	m	gyru	mj	sv	g	l	
Dutilleul. L. Syns. Gen. Dutilleul, General Dutilleul	Belg	oblp	s	yru	jm	s	g	m	
Du Tonneau. E'54,334,'59,346. D'57,537,'69,835. Syn. of Pound									
Duval. L. T'97,460. Syns. Audibert, Beurre Duval, Beurre Incomparable, Dwael, Rio Louis Nouveau.	Belg	oblp	ml	ybru	jm	s	g-vg	m	Raised by M. Duval.
Duvemay. F279. D'69,736. Syn. of Devergnies									
Duvernis. D'69,736. Syn. of Devergnies									
Duvivier. MassH'48,100. Syns. Beurre Duvivier, General Duvivier	For	obo	s	gru	g	s	p		
Dvinnoe Selovieff. CanExFR'96,136. EFABC'00									Not described.
Dwael. D'69,688. Syn. of Duval									
Earle. Hort'63,148. Syn. of Herkimer									

Earle Bergamot. R. Syns. Earle's Bergamot, Earle's Russet	Mass.	obtp	m	gyru	mj	p	vg		Raised by J. M. Earle, of Worcester, Mass.
Earle's Bergamot. MassH'81,232. A'81,166,'83,93,'85,17. Syn. of Earle Bergamot									
Earle's Russet. GarM'71,125. Syn. of Earle Bergamot									
Earl Pear. D'69,783. Syn. of Herkimer									
Early Bell (of New England). MagofH'37,49. Syn. of Windsor									
Early Bergamot. Cult'39,66. D'45,333,'57,565,'69,751. E'54,394,'59,421. H154. F277. Syn. of Early Bergamot (of Downing).									
Early Bergamot (of Downing). R. Syns. Bergamotte Precoce, Early Bergamot, Early French Bergamot.	Fr.	r	m	yg	jm	s	vg	me	This and Early Bergamot of Prince may be identical.
Early Bergamot. IaH'77,387,'84,508. FGAofO'89,3. Syn. of Early Bergamot (of Gibb).									
Early Bergamot. Pr69. K'32,155,'41,132. KanH'82,135. Syn. of Early Bergamot (of Prince).									
Early Bergamot (of Gibb). R. Syns. Bergamot rannaya, Bergamot rannui, Early Bergamot.	Rus?							me	Introduced from Russia in 1879.
Early Bergamot (of Prince). R. Syns. De Huchet, Early Bergamot		r	m	gyr	jeo	s		me	Possibly identical with Early Bergamot of Downing.
Early Bergamot of Wisconsin. WisH'71,150 '73,24,'87,75. Dap155. IaH'77,384,'78,264. Syn. of Portugal.									
Early Beurre. Pr93. GenF'33,196. Cult'39,66. D'45,331,'57,563,'69,658. E'54,388,'59,417. F276. Syn. of Ambrosia.									
Early Beurre. K'32,126,'41,126. MagofH'43,366. D'45,332,'57,428,'69,703. AgR'62,182. Syn. of Bloodgood.									
Early Butter. SW. IndF'40,182. Syn. of Craig									
Early Butter (of Cincinnati). E'54,367,'59,381. A'60,208. D'69,751. OH'85,177. Syn. of Craig.									
Early Butter of Indiana. WHRIV,203. H154. OH'85,177. Syn. of Craig									
Early Butter (of Mears). IllH'60,57. Syn. of Craig									
Early Catherine. C178. D'54,343,'57,581,'69,846. AgR'54,283,'56,344. E'54,394,'59,421. F282. A'62,68. IndH'63,13. Hort'71,319. T'75,545,'85,560,'97,701. Syn. of Early Rousselet.									
Early Chaumontelle. Pr13. K'32,129,'41,118. GenF'37,277. D'69,809. Syn. of Madeleine.									
Early Chaumontel (incorrectly). D'45,341,'57,441. F281. Syn. of Madeleine									
Early Cluster. A'79,131									Not described.
Early Doyenne. E'54,394,'59,421. D'57,572,'69,833. MagofH'59,399. Syn. of Pinneo.									
Early Duchess. MichSB27. MichB177,194. CanExFR'00,461. EFABC'00. AHM243. Syn. Duchesse Precoce.	Fr.	obtp	ml	yr	cojm	sv	g	me	
Early Elliot. R. Syns. Eliot, Eliot's Early, Elliot, Elliot's Early, Elliott's Early.	Can.	p	s	gybr	jm	sp	g vg	e	Originated by C. Elliot, of Windsor, Ontario.
Early French Bergamot. Pr69. Syn. of Early Bergamot (of Downing)									
Early German. H141. Syn. of Chancellor									
Early Green Chisel. WPr8									Probably same as Chisel.
Early Green Sugar. A'87,141. BBL.									Being tested by Benjamin Buckman, Farmingdale, Ill.
Early Harvest. IllH'86,180,'87,50,'89,159,'91 104. HAJ'89,26. GaH'91,31,'97,81. NebH'90,120,'91,59,180,'95,262. BBL. AHM243.	Amer.								Early Harvest and Chambers are probably identical.
Early Harvest. FESofO'91,11. Syn. of Chambers									
Early Harvest (of Ky.) AN&OCo. Syn. of Chambers									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Early Harvest of New Jersey. MichB31									Not described; possibly distinct.
Early Harvest of Ohio. MichB31									Not described; possibly distinct.
Early Katharine. SW. Syn. of Early Rousselet									
Early Madelaine. CanExFR'98,400. EFABC'00. Syn. of Madeleine									
Early Market. IllH'96,194.'98,173. Syn. of Market									
Early Napoleon. MinnH'83,68,70									Probably not Napoleon.
Early Queen. GenF'33.197. D'45,341,'57,578,'69,818. E'54,397,'59,423. F281. Syn. of Muscat Robert.									
Early Rose Angle. GenF'33,196. Syn. of Madeleine									
Early Rousselet. Pr20. K'32,122. IndF'40,182. D'45,343,'57,581. E'54,394,'59,421. H154,184. F282. A'62,68. OH'64,12. T'75,545,'85,560,'97,701. Syns. Catharine, Cyprus Pear, Early Catharine, Early Katharine, Green Catharine Kattern, Perdreau, Poire de Chypre, Rousselet Hatif, Rousselette Hatif, Rousselet Perdreau, Turner's Early (of Illinois).		ap	ms	ybr	co	sp		me	Apt to rot at core; not valuable
Early Rousselet. Pr138. Syn. of Skinless									
Early Ruselet. Th191. Syn. of Skinless									
Early Russian. EWK'94			m		m		vg		Praised by E. W. Kirkpatrick, of Texas.
Early St. Germain. Hort'49,567,'56,155. E'54,358,'59,371. Hof. Syn. of Chancellor.									
Early Sugar. Pr9. K'32,131. IndF'40,181. E'54,366,'59,381. H154. D'69,779 Syn. of Harvest.									
Early Sugar. D'45,330,'57,450. Syn. of Joannet									
Early Summer. AgR'55,296. [This may be Craig]									
Early Summer Bergamot. C179. Syn. of Summer Bergamot.									
Early Summer Butter. D'69,751. Syn. of Craig.									
Early Wilbur. MassH'43,4. MagofH'44,156. Syn. of Wilbur.									
Early Wilder. IllH'96,45. BBL. Syn. of Wilder Early									
Early Williams. L. Syn. Williams' Early	Mass.	rp	s	y	cojb	p	g	me	Originated by A. D. Williams, of Roxbury, Mass.
Early York. F273. Syn. of York									
Easter. S92. Bl229. Bul6,8. Syn. of Easter Beurre									
Easter Belle. AHM243. Syn. of Eastern Belle									
Easter Bergamot. DomEncIV,183. GarCal587. C199. Th186. Pr77. K'32,142,'41,124. D'45,429,'57,564,'69,751. Cole174. E'54,389,'59.417. H155. Syns. Andersons' Favorite, Bergamot d'Hiver, Bergamot Easter, Bergamotte de Bugi, Bergamotte de Careme, Bergamotte d'Hiver, Bergamotte de la Grilliere, Bergamotte de Paques, Bergamotte de Pasques, Bergamotte de Toulouse, Bergamotte Ronde d'Hiver, Bergamotte Soldat Nabours, Beurre d'Hiver, Bonner's Pope's Pear, Bugi, Cape May, Doyenne d'Hiver, La Grillieu, Taddrington, Robert's Keeping, Royal Tairling, St. Herblain d'Hiver, Soldat, Tarling, Tarling or Terling, Terling, Tuling, Winter Bergamot, Winter Bergamotte.	Fr	robs	m	gy	crj	v	g	vl	An old French variety; good only for cooking.

Easter Beurre. Pr53. K'32,193,'41,160. GenF'33,198'37,278. IndF'40,183. M'38,95. D'45,'425,'57,427,'69,251. Cole173. MagofH'50,73. AgR'50,94. H154. F214. Fi53. MVHS'83,130. WnI,328,II,338,III,260. AHM243. Syns. Belle d'Helles, Bergamot pentecote, Bergamotte de la Pentecote, Beurre d'Austerlitz, Beurre d' Hiver de Bruxelles, Beurre d'Hyver Nouvelle espece, Beurre de la Pentecote, Beurre de Paques, Beurre Easter, Beurre Gris d'Hiver Nouveau, Beurre Roupe, Bezi Chaumontel Tres-Gros, Canning, Canning Seigneur d'Hiver, Canning d'Hiver, Chaumontelle Tres-Gros, Doyenne d'Hiver, Doyenne du Printemps, Du Patre, Easter, Merveille de la Nature, Paques, Pastorale, Pastorale d'Hiver, Pater Noster, Philippe de Pasque, Seigneur d'Hiver, Siegneur d'Hiver, Winter Beurre.	Fl.	robt	l	gyrub	gbmj	s	g-vg	vl	One of the finest late winter varieties.
Eastern Belle. MassH'70,52,'71,42,'72,91,'74,153. A'75,66,'77,100. MeP'73,44,'88,110, 123. Dap126. T'75,543,'85,560,'97,701. Syn. Easter Belle.	Me	obop	m	yrru	cojm	sp	vg	me	Raised by H. McLaughlin, of Bangor, Me.
Easter Saint Germain. Pr78. K'32,147,'41,125. D'69,800. Syn. of Lent									
Eastnor. L. Syn. Eastnor Castle		r	m	g	jm			l	
Eastnor Castle. MagofH'54,137. D'57,572,'69,752. F280. T'75,545,'85,560,'97,701. Syn. of Eastnor.									
Echasserie. Pr124. GenF'33,196. M'38,94'44,80. Cult'39,66. K'41,123. D'45,435,'57,572,'69,753. E'54,367,'59,380. AgR'56,368. F280. Syns. Ambrette, Ambrette (of Coxe), Besidery Landry, Besidery Sandry, Bezi de Chasseray, Bezi de Chasseri, Bezi de Chasserie, Bezi d'Echassie, Bezi d'Echassery, Bezi d'Echassey, Bezi l'Echasserie, Bezy de Chassery, Echassery, Eschassery, Jagdbirne, Landry Wilding, L'Echasserie, Leschasserie, Tilton of New Jersey, Verte Longue d'Hiver, Wilding of Echassery, Winter Green Long, Winter Long Green, Yat or Yut Pear.	Fr.	rov	m	gy	mb	sp	vg	vl	Of second quality, but very productive.
Echassery. Pr124. K'32,144. IndF'40,136. D'45,435,'69,753. Cole173. AgR'54,293. E'54,367,'59,381. F278. T'75,545,'85,560,'97,701. Syn. of Echasserie.									
Ecole. L. Syn. Beurre d'Ecole	For								Not described; published by Field, p. 278.
Ecully. L. Syns. Belle d'Ecully. Premices d'Ecully	Fr.	obp	ms	yru	cojm	sp	g	me	Originated at Ecully, near Lyons, France.
Eddie Wilder. MassH'75,152,'75,129	Mass.								Named for a son of Col. M. P. Wilder.
Edel Crassane. AofH'91,296									Not described.
Eder. MichH'76,143									Not described; perhaps a local variety.
Edmonds. A'64,101,'67,149. AJofHIV,49. Cult'65,76. D'69,753. Hort'70,86. CGenXXIII,190,XXIV,225. MichH'74,27,265. T'75,274,'85,292,'97,469. B'83,380. AHM-243.	N.Y	obtp	l	yrru	gjm	s	vg	me	A chance seedling on the farm of E. Edmonds.
Edouard. L. Syn. Abbe Edouard	Belg.	robtp	m	gyru	mj	s		ml	Originated by Dr. John Van Mons.
Edouard Sageret. F280. Syn. of Sageret (Edouard)									
Edouard Morren. MagofH'57,260. D'69,754. Syn. of Morren									
Edwards. MagofH'38,231,'45,252. Cult'45,174. D'57,572,'69,754. F273. T'75,545,'85,560,'97,701. IllH'84,82.	Conn.	obtp	m	y	cog		vg	me	Raised by Gov. Edwards, of New Haven, Conn.
Edwards (Brinckle). L. Syn. Edwards' Seedling St. Germain	Pa	rp	m	yru	cojm	s	g	ml	Raised by Dr. Brinckle, of Philadelphia.
Edwards' Elizabeth. D'45,385,'57,496,'69,754. MagofH'46,441. Cole160. T'75,546,'85,561,'97,701. Syn. of Elizabeth (Edwards).									
Edward's Henrietta. D'45,385. B'51,300. E'54,370,'59,390. H155. T'75,225,'85,273,'97,454. Syn. of Henrietta.									
Edwards Meadow. MagofH'53,423									Not described.
Edwards' Seedling St. Germain. D'69,754. Syn. of Edwards (Brinckle)									
Edwards (William). H155									Not described; may be William (Edw.)

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Edwidge. D'69,880. Syn. of White Doyenne									
Egerie. Dap127	Fr	robtp	m	yru	jm	sv	g-rg	m	A chance seedling at Angers, France.
Egg Pear. DomEncIV,186. Pr36. K'41,119. CGenXII,125. Syn. of Swan Egg									
Egmont. L. Syn. Comte d'Egmont		obo	s	yrbru	mg	s	g	m	Description from Hogg's Fruit Manual.
Eisenbart. D'69,710. Syn. of Brown									
Elberg. R. Syn. Beurre d'Elberg									Published in Magazine of Horticulture, 1847, p. 562.
Eleonie. L. Syn. Eleonie Bouvier	Belg	oblp	ms	yru	co	s	g	me	Scarcely known in this country.
Eleonie Bouvier. MagofH'57,260. D'69,754. Syn. of Eleonie									
Eliot. AHM243. Syn. of Early Elliot									
Eliot's Early. A'71,52,'79,64. Dap127. CanH'78,154. AofH'92,277. AHM243. Syn. of Early Elliot.									
Eliott Dundas. F279. D'69,750. Syn. of Dundas									
Elise d'Heyst. MagofH'48,209. AgR'54,246. Syn. of Heyst (Eliza)									
Elizabeth. HMHS258. Bul6,8. Syns. Elizabeth de Van Mons, Elizabeth (Manning), Elizabeth Van Mons, Manning's Elizabeth, Manning's Elizabeth Burre de Jelles, Nana, Nina, 158 Van Mons. Van Mons No. 154.	Belg	obtp	ms	yr	jm	sp	vg-b	me	Originated by Dr. John Van Mons; named by Mr. Manning.
Elizabeth de Van Mons. FGAofO'92,111. Syn. of Elizabeth									
Elizabeth (Edwards). MassH'43,5. MagofH'45,437, 49,43. E'54,366,'59,381. H155. F273. T'85,561. Syn. Edwards' Elizabeth.	Conn.	obtp	ml	yg	b	v	g	m	Raised at New Haven, Conn., by Governor Edwards.
Elizabeth (Mannings). MagofH'42,57,'47,63. E'54,366,'59,342. H155. F280. Syn. of Elizabeth.									
Elizabeth Maury. Dap.147. Syn. of Maury									
Elizabeth Van Mons. HovII,41. E'54,366,'59,342. D'69,810. Syn. of Elizabeth									
Eliza d'Heyst. F280. E'59,359. D'69,754. Syn. of Heyst (Eliza)									
Eliza d'Heyst. E'54,350. Syn. of Napoleon									
Ellanrioch. D'45,333,'57,565,'69,778. E'54,396,'59,422. F277. Syn. of Hampden									
Elliot's Early. FGAofO'71,20,'72,10,63,'74,8,58,'82,55,'84,194. CanH'79,8,'83,83,'87,33. HIH'96,178,204. Syn. of Early Elliot.									
Elliot. FGAofO'87,87. Syn. of Early Elliot									
Elliott. L. Syn. Elliott's Melting	Pa	r	ms	gru	jm	sp	g-vg	me	Raised by Betsey Elliott, of Carlisle, Pa., in 1809.
Elliott Dundas. D'57,489. Syn. of Dundas									
Elliott's Early A'77,89. EFABC'00. CanExFR'04,479. Syn. of Early Elliot									
Elliott's Melting. D'69,755. Syn. of Elliott									
Ellis (1st). MassH'64,42. A'67,151. AJofHIV,50. D'69,755,T'75,546,'85,561,'97,701. MeP'94,20. EFABC'00.	Mass.	oblp	l	gyru	jm	svp	vg	m	Raised by Mrs. Ellis, of New Bedford, Mass., in 1843.
Ellis (2nd). D'69,256	N. Y.	ap	m	gyr	jm	va	g	me	Distinct from the preceding.
Ellsworth. D'69,756		rp	m	gy	co	s		m	Not considered valuable.
Elsa. R. Syn. Duchesse Elsa									In collection at Agassiz, B. C.

Elton. Pr196. K'32,136,'41,127. GenF'37,277. MagofH'50,296. A'54,238. D'69,756.	Eng....	ovobo	m	gru	bej	......	vg	me	Originated in Herefordshire about three centuries since.
Elvira. OH'03,154	......	......	......	......	......	......	......	vl	Exhibited by F. F. Bernard at meeting of Ohio Horticultural Society, 1903.
Emerald. K'41,161. D'45,135,'57,572,'69,756. MagofH'52,137. E'54,394,'59,421. F289. T'75,546,'85,561,'97,701. Syn. Epargne.	Belg....	obtp	m	yb	meoj	v	g	ml	Variable in quality; sometimes good.
Emerance. D'69,756. Syn. Emerance Bivort........	Eur....	obop	l	gyru	jm	s	g	me	A strong grower, but rambling in habit.
Emerance Bivort. D'69,756. Syn. of Emerance........	......	......	......	......	......	......	......	......	
Emhart. BBL........	......	......	......	......	......	......	......	......	In Benjamin Buckman's collection at Farmingdale, Ill.
Emigrant. CGenXIV,321........	......	......	......	......	......	......	......	......	Not described.
Emile Bivort. E'59,382. T'75,546,'85,561,'97,701. Syn. of Emilie Bivort........	......	......	......	......	......	......	......	......	
Emilie d'Heyst. MassH'53,21,'77,79,'82,24,'86,27. MagofH'54,86. AgR'56,331,'75,379. D'57,296,'69,757. E'59,382. F280. AJofHV,327. T'75,263,'85,281,'97,460. B'83,369. L&B94. AHM249. Syn. of Heyst (Emile).	......	......	......	......	......	......	......	......	
Emile de Rochois. D'69,668. Syn. of Dundas........	......	......	......	......	......	......	......	......	
Emilie L. Syn. Bonne Emilie........	For....	......	......	......	......	......	......	......	Not described by Field on page 278.
Emilie Bivort. D'69,756. Syns. Emile Bivort, Emily Bivort........	Belg....	robo	ms	yru	jm	sa	vg	m	Raised by M. Bouvier; dedicated to A. Bivort.
Emily. MagofH'38,466........	Conn....	......	......	......	......	......	......	......	Exhibited by Governor Edwards at meeting of New Haven Horticultural Society, 1838.
Emily Bivort. D'57,497,'69,756. Syn. of Emilie Bivort........	......	......	......	......	......	......	......	......	
Emmanuel. D'69,717. Syn. of Summer Certeau........	......	......	......	......	......	......	......	......	
Emmilacour. D'69,815. Syn. of Messire........	......	......	......	......	......	......	......	......	
Emperor Alexander. R. Syn. Beurre Emperor Alexander........	......	......	......	......	......	......	vg	l	Published by Magazine of Horticulture, 1854, p. 234.
Emperor d'Autriche. K'41,169........	......	......	......	......	......	......	......	......	Kenrick called it new and promising.
Endicott. MagofH'37,50,'39,395,'40,173,'50,296,'53,254,257. MassH'37,30. Cult'40,186. WHRI,240. IndH'72,50,'75,42. MinnH'76,43. CGenXII,254. A'79,80. Syns. Great Pear, Sugar Pear.	......	......	......	......	......	......	......	......	Tree remarkable for its great age and size. Planted by Gov. Endicott in 1630; still living in 1860.
Enfant Prodige. MagofH'42,00. MassH'44,61. E'54,395. Hort'56,136. H156. Syn. of Enfant Prodigue.	......	......	......	......	......	......	......	......	
Enfant Prodigue. D'45,386,'57,540,'69,846. WHRIII,162. F280,282. E'59,421. T'75,546,'85,561,'97,701. Syns. Enfant Prodige, Nectarine, Rousselet Enfant Prodigue.	Belg....	p	m	gru	jg	vp	g	m	Originated by Dr. John Van Mons.
Enfant Vantais. E&ABC'00. Syn. of Vantais........	......	......	......	......	......	......	......	......	
Enghiem. L. Syn. Bronze d'Enghiem........	Belg....	ovp	m	ybru	cjm	va	g	l	Originated in the Province of Hainaut.
Englebert Lott. A'58,196. D'69,779. Syn. of Harrison........	......	......	......	......	......	......	......	......	
English Autumn Bergamot. Pr71. D'45,366,'57,565,'69,663. E'54,389,'59,417. F277. Syn. of Bergamot (Aut.)	......	......	......	......	......	......	......	......	
English Bell. CGenXII,334. Syn. of Pound........	......	......	......	......	......	......	......	......	
English Bergamot. Pr71. GenF'33,196. D'45,366,'57,565,'69,663. E'54,389,'59,417. F277. T'75,546,'85,561,'97,701. Syn. of Bergamot (Aut.)	......	......	......	......	......	......	......	......	
English Beurre. C192. D'45,351,'57,563,'69,661. E'54,388,'59,417. F276. Syn. of Angleterre.	......	......	......	......	......	......	......	......	
English Caillot Rosat. GenF'33,196. Syn. of Rose (Sum.)........	......	......	......	......	......	......	......	......	
English Catharine. K'32,140,'41,127. Syn. of Red Cheek........	......	......	......	......	......	......	......	......	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
English Jargonelle. IndF'40,182. AgR'50,94,'56,347. D'69,758. AJofHVIII,223. MoH'64,31 T'85,571. Syn. of Jargonelle (Eng.)									
English Red Cheek. D'45,339,'57,514,'69,767. E'54,395,'59,421. H124. F280. Syn. of Jargonelle (Fr.)									
English Red Cheek. WPr11. Pr148. K'32,140,'41,127. Syn. of Red Cheek									
English Warden. A'54,238									This may be Pickering. See transactions of the American Pomological Society, 1875, p. 102.
English Warden. A'75,102. Syn. of Pickering									
Ennes of Kentucky. Dap155. A'75,68. Syn. of Windsor									
Eparque. L16. Syn. of Emerald									
Eparque. Pr152. K'32,128,'41,118. GenF'33,197,'37,277. MagofH'37,12. Cult'39,66. D'45,337,'57,594,'69,758. E'54,373,'59,393. H156. T'75,549,'85,564,'97,706. EFABC'00. Syn. of Jargonelle (Eng.)									
Epine d'Ete. GenF'37,277. Syn. of Cuisse Madame									
Epine d'Ete. Pr38. D'45,345,'57,583. F282. Syn. of Rose (Sum.)									
Epine d'Ete. DomEncIV,186. GarCal587. Pr28. K'32,127,'41,120. MagofH'45,336. D'45,341,'57,573,'69,758. E'54,399,'59,424. A'54,239. F280. T'75,546,'85,561,'97,701. CanExFR'00,462. EFABC'00. Syn. of Summer Thorn.									
Epine d'Ete Couleur Rose. D'45,345,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Rose (Sum.)									
Epine d'Ete de Thoulouse. Pr28. Syn. of Thoulouse									
Epine d'Ete petite. Pr28. Syn. of Summer Thorn									
Epine d'Hiver. C199. Th193. Pr105. K'32,145,'41,122. Cult'39,66. D'69,885. Syn. of Winter Thorn.									
Epine d'Hyver. DomEncIV,185. GarCal587. Syn. of Winter Thorn									
Epine de Limoges. D'57,454,'69,668. F276. Syn. of Dumas									
Epine de Rochefort. F276. Syn. of Dumas									
Epine Dumas. AgR'54.245. F193,276. E'59,360. A'62,66. D'69,668. EFABC'00. Syn. of Dumas.									
Epine Dumas. E'54,344. AgR'56,366. IllH'69,156. Syn. of Vicar									
Epine du Rochair. D'57,454,'69,668. F276. Syn. of Dumas									
Epine du Rochais. F276. Syn. of Dumas									
Epine Rose. Pr38. K'32,132,'41,119. Cult'39,66. D'45,345,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Rose (Sum.)									
Epine Rose d'Hiver. D'69,885. Syn. of Winter Thorn									
Epine Rose Gris. D'69,851. Syn. of Salviata									
Epine Royale. D'69,758. Syn. of Royal Thorn									
Epineuse. F276. Syn. of Ambrette									
Episcopal. MagofH'46,338. WHRI,48. E'54,395,'59,421. D'57,573,'69,766. H158. F280. T'75,546,'85,561,'97,701. Syn. of Fortunee.									
Erhard's Ravenswood. Hort'59 477. Syn. of Ravenswood									
Erhard's Seedling. Hort'60,194. Syn. of Ravenswood									

Ermesinde. D'69,758.	Fr.	oblp	l	gru	djm	s		m	From Album of Pomology.
Ernest. R. Syn. Charles Ernest									In the experimental orchard at Agassiz, B. C.
Ernestine Auzolle. D'69,758. Syn. of Auzolle									
Erwin. BBL									On trial with Benjamin Buckman, Farmingdale, Ill.
Eschassery. Pr124 Syn. of Echasserie									
Eseme. IaH'80,61									Probably a Russian variety.
Eshleman. MagofH'60,502. D'69,784. Syn. of Hosenschenck									
Espadonne. MagofH'52,466									Exhibited by Hovey & Co., at meeting of Massachusetts Horticultural Society, 1852.
Espargue. Pr152. IndH'40,182. D'69,758. T'85,564. Syn. of Jargonelle (Eng.)									
Esperen. L. T'97,701. AHM243. Syns. Rousselet d'Esperin, Rousselet Double Rousselet Double Esperin, Rousselet Esperen.		obop	m	yru	j	svp	g	me	Tree vigorous and very productive.
Esperen No. 2. OH'77,121,'79,5	Fr.?								Exhibited by Leo Weltz at Ohio State Fair, 1877.
Esperens Bergamotte. AofH'91,296									Name quoted from a German publication.
Esperew. L. Syn. Rousselette d'Esperew									Published by Kenrick, 1841, p. 170; not described.
Esperine. MagofH'42,165. D'57,498,'69,759. EFABC'00. Syns. Beurre Esperin, Beurre Sprin.	Belg.	p	l	gyrru	bmj	s	g-vg	m	Raised by Dr. John Van Mons; named for Maj. Esperen.
Esperine. Cult'47,340. D'69,656. Syn. of Mon Dieu									
Esperine (Beurre 'd). Mag ofH'48,111								vl	Claimed to be of first quality and very late.
Esperin's Herrenbirne. D'69,762. Syn. of Lucrative									
Esperin Soldier. E'54,337. Syn. of Soldat									
Esperione. T'85,561		obop	m	y	jm	p		me	
Esperne. L. Syn. Musquee d'Esperne	For.								Published by Field, p 281, as Musquee d'Esperne.
Essex. D'69,759	N. Y.	oblp	ms	gyb	jmg	s	g	me	Origin, Essex County, New York. Introduced by J. Batty.
Estainot. R. Syn. President de l'Estainot									Not described.
Esterhazy. L. Syn. Prince Esterhazy									Published by Kenrick, 1841, p. 169; not described.
Esther Conte. MassH'62,32	For.								Fruited near Boston, Mass., in 1862.
Estrapa. R. Syn. Beurre d'Estrapa									Exhibited by Robert Manning in 1851.
Esturion. D'69,759	Eur.	obop	s	yru	co		p	me	
Esturion. Dap155. A'75,68. Syn. of Winter Nelis									
Etourneau. D'45,450,'57,447,'69,884. HovI,15. E'54,346,'59,355. F283. AgR'62,190. Syn. of Winter Nelis.									
Etranglee. MagofH'43,131									Not described.
Eugene. L. EFABC'00. Syn. Eugene Appert	Fr.	robtp	ms	gyru	jm	sp	vg	me	Originated by Andre Leroy of Angers, France.
Eugene Appert. OH'71,48. Hort'72,102,'74,148. A'73,61,'81,30. Dap175. AgR'75, 381. T'75,546,'85,561,'97,701. MichH'75,89,285. B'83,380. AHM244. Syn. of Eugene.									
Eugene Van Berkelaire. MagofH'57,260. Syn. of Van Berkelaire									
European Honey. D'69,784. AJofHV,179. Syn. of Honey									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Eva Baltet. CanExFR'05,430		obp	l	gyr	j	s		m	In the experimental orchard at Agassiz, B. C.
Everard. R Syn. Delices Everard									In the experimental orchard at Agassiz, B. C.
Everlasting. IllH'93,76									Shown at World's Columbian Exposition; not described.
Ewer. HMHS4	Mass.								Originated in Massachusetts Colony at a very early date.
Excellentissema. K'41,131. MassH'45,88,'72,91. MagofH'47,525. B'51,305. E'54, 394,'59,379. T'75,546,'85,561,'97,701. Syn. of Brabant.									
Excelsior. MagofH'59,471. A'67,158. D'69,759. CGenXXIII,190. MassH'82,38. Syns. Dana's Excelsior, Dana's Seedling No. 12, Excelsior No. 12.	Mass.	obtp	m	gyru	jm		g-vg	me	Raised by Francis Dana, of Boston, Mass.
Excelsior No. 12. MagofH'59,204. Syn. of Excelsior									
Exeglovka. EFABC'00									In the experimental orchard at Agassiz, B. C.
Exeter. EFABC'00									In the experimental orchard at Agassiz, B. C.
Eyer Pear. Pr36. Syn. of Swan Egg									
Eyewood. K'41,144. D'45,386,'57,573,'69,759. MagofH'46,147,'47,154. Cole160. B-'51,316. Cult'52,36. E'54,367,'59,382. H156. F280. T'75,546,'85,561,'97,701. AofH'89, 151.	Eng.	obl	m	ygru	b	v	g-vg	m	Raised by Dr. Thomas Andrew Knight.
Ezee. L. Syns. Belle et bonne d'Ezee, Belle et Bonne des Zees, Bon d'Ezee, Bonne d'Ezee, Bonne de Longueval, Bonne des Haies, Bonne des Zees, Bonne de Zees.	Fr?	oblp	l	ygru	jm	s	g-vg	m	Introduced from Europe in 1844.
Fall. A'75,102	Mass.	ov	s	gru			p	m	Tree planted in 1650; still living in 1836.
Fall Beurre d'Aremberg. Dap175. Syn. of Aremberg (Aut.)									
Fall Butter. IndF'40,105,136,182. A'73,105. OreH'91,13,'93,85,'97,23,'99,151,461. Syn. of White Doyenne.									
Fall d'Aremberg. MassH'74,158. A'75,119		r	m	ybru		v			May be Aremberg (Aut.).
Fall Sugar. MassH'44,62									Exhibited at meeting of Massachusetts Horticultural Society in 1844.
False Spreciew. D'69,827. Syn. of Paradise									
Fame. SBros. IllH'97,213									On trial at Illinois Agricultural experiment stations.
Famenga. GenF'33,196. Cult'39,66. MagofH'43,388,'50,296. MassH'44,59. A'54,238. E'54,395,'59,421. D'69,759.	Eur.	obo	m	gy				me	Description from Elliott.
Fanfareau. D'69,778. Syn. of Hampden									
Fantasie. R. Syn. Fantasie Van Mons									Rejected by Congress of Fruit Growers in 1849.
Fantasie Van Mons. MassH'45,89. MagofH'50,296. A'54,238. Syn. of Fantasie.									
Farim Maria Louise. F248. Syn. of Marie Louise									

Farmington. R. Syn. Farmington Summer	Conn	obl			j	s		e	A very old tree at Farmington, Conn.
Farmington Summer. GenF'73,38. Syn. of Farmington.									
Farragut. MassH'66,44. Syns. Admiral. Admiral Farragut, Amiral, Colmar Charnay.	Mass	p	vl	gr	mj	sa		me	Raised by Dr. S. A. Shurtleff, of Brookline, Mass.
Farrow. R. Syn. Farrow Cow									Published in Magazine of Horticulture in 1843, p. 131.
Farrow Cow. MagofH'43,131. Syn. of Farrow									
Father's Keepsake. Gb. Syn. of Keepsake									
Faurite. R. Syn. Poire Faurite			s					vl	Published in Magazine of Horticulture, 1848, p. 111.
Fausse Spreaw. MagofH'42,250. Syn. of Spreuw									
Fausse Spreuw. K'41,170. Syn. of Spreuw									
Faux Bolivar. D'69,835. Syn. of Pound									
Faux Speciew. D'69,827. Syn. of Paradise									
Favori Musque. Dap155. A'75,68. Syn. of Ananas									
Favori Musque. D'69,660. Dap155. Syn. of Ananas d'Ete									
Favori Musque. F280. Syn. of Henry IV									
Favori Musque du Conseiller. D'57,507,'69,782. Syn. of Henry IV									
Favori Musque du Conseiller V. M. Dap155. A'75,68. Syn. of Ananas									
Favourite Morrel. EFABC'00. Syn. of Morrel									
Favre. L. Syn. Souvenir Favre	Fr	oblp	ml	yr	comj	sp		l	Originated by M. Favre in 1850. Fruited in 1857.
Favre (Souv.). L. Syn. Souvenir Favre	Fr	obop	m	gyr	jm	sp	g-vg	m	Originated by M. Favre at Chalons.
Fays. R. Syn. Countess Clara Fays									In the trial collection at Agassiz, B. C.
Feast. D'69,759. Syn. Feast's Seedling	Md	obop	m	gy	j	s	g	me	Originated from Seckel seed at Baltimore, by Samuel Feast.
Feaster. A'52,92,'54,84. MagofH'53,566. AgR'54,272. E'54,391,'59,368. D'57,567, '69,703. H137. T'75,546,'85,561,'97,701. Syn. of Bleecker.									
Feast's Seedling. MagofH'40,36. D'69,759. Syn. of Feast									
February. R. Syn. February Pear								vl	Exhibited in St. Louis, September, 1847, by E. Mallinckrodt.
February Pear. Hort'47,246. Syn. of February									
Feigen. Gb. Syn. Feigenbirne	Rus?								In Gibb's list of undescribed varieties.
Feigenbirne. Gb. Syn. of Feigen									
Felicite Dundas. D'69,750. Syn. of Dundas									
Felix de Leim. Hort'68,303. D'69,759. AHortA'69,79. Syn. of Leim									
Felton. L. Syn. President Felton	Pa	robl	m	yru	jm	vs	g	m	Originated with Dr. W. D. Brinckle, of Philadelphia, Pa.
Feodale. F280. Syn. of Flemish									
Ferdinand de Meester. D'45,409,'57,581,'69,814. B'51,316. E'54,398,'59,424. F282. T'75,546,'85,561,'97,701. Syn. by Marie Parent.									
Ferdinand Demeester. MagofH'48,110. D'69,864. Syn. of Meuris									
Ferdinand Gaillard. EFABC'00. CanExFR'05,431. Syn. of Gaillard									
Ferron. L. Syn. Belle de Ferron	For								Published by Field, on p. 276; not described.
Fertility. HAFS'88,74. CanH'89,10,11. IHH'98,184,'01,255. FGAofO'93,146. AndN '95. CanExFR'96,446. EFABC'00.		obov	m	yb	jm		p	m	In the experimental orchard at Agassiz, B. C.
Fetel. R. Syn. Calebasse Abbe Fetel									In the experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Fevrier. L. Syn. Beurre de Fevrier	Fr	oblp	m	gyr	dmjg	svp		vl	Originated in Rouen, France. Described by Leroy.
Fieve. R. Syn. Bergamot Fieve									Published in Magazine of Horticulture, 1854, p. 136.
Fig d'Alencon. E'59,382. Syn. of Figue									
Fig Extra. R. Syn. Fig Extra (of Van Mons)									
Fig Extra (of Van Mons). MassH'45,89. Syn. of Fig Extra									
Fig Pear (of Naples). M'38,91,'44,78. D'45,388,'57,498,'69,760. E'54,367,'59,382. F280. T'85,293. Syn. of Naples.									
Figue. Pr27. MagofH'48 65. Cole167. B'51,316. E'54,368,'59,382. H156. D'69,710. T'75,263,'85,281,'97,460. Syns. Blossomless pear, Bonnisseme, Bonnissima de la Sartha, Figue d'Alencon, Fig d'Alencon, Figue d'Alencon d'Hiver, Figue d'Hiver, Figue d'Hiver d'Alencon, Figue Vert, Grosse Figue, Petalless, Pettalless, Pistollette, Poire Figue, Sylvange d'Hiver, Verte Longue d'Angers, Verte Longue de la Mayenne.	Fr	oblp	l	gybru	jm	sv	vg	l	Originated in Alencon, France.
Figue. L. Syn. Beurre Figue		r	m	gy	tj		g	me	Cultivated by the late A. H. Ernst, of Cincinnati, Ohio.
Figue d'Alencon. AgR'54,243. D'57,498,'69,760. F280. A'62,68. IllH'69,156. MoH'69,498. T'75,263,'85,281,'97,460. EFABC'00. Syn. of Figue.									
Figue d'Alencon d'Hiver. D'69,760. Syn. of Figue									
Figue d'Hiver. F280. D'69,760. Syn. of Figue									
Figue d'Hiver d'Alencon. D'69,760. Syn. of Figue									
Figue de Naples. GenF'33,196. K'41,144. D'45,388,'57,498,'69,760. MagofH'47,337. E'54,366,'59,382. H156. F280. T'75,275,'85,293,'97,462. Syn. of Naples.									
Figue of Naples. MagofH'37,48,'40,44. E'54,367,'59,382. Syn. of Naples									
Figue Vert. E'54,368,'59,382. Syn. of Figue									
Figuier. L. Syn Belle de Figuier	Fr	robtp	ml	grb	jmg			l	Originated at Angers, France, in 1860.
Fin. R. Syn. Fin Or d'Ete									Published in Magazine of Horticulture, 1843, p. 131.
Fine Gold. R. Syn. Fin Or d'Orleans									Published by Kenrick, 1841, p. 130; not described.
Fine Gold of September. Pr65. Syn. of Fine Gold (Sept.)									
Fine Gold of Summer. C180. SW. K'41,119. APC'50,11. E'54,395,'59,421. D'57,573,'69,760. T'75,546,'85,561,'97,702. Syn. of Fine Gold (Sum.).									
Fine Gold of Winter. Pr104. O'69,766. Syn. of Franc Real (Win.)									
Fine Gold (Sept.). L. Syns. Fine Gold of September, Fin Or d'Orleans, Fin Or de Septembre.	For		s	g	m	a		me	
Fine Gold (Sum.). L. Syns. Fine Gold of Summer, Fin Or d'Ete, Gold of Summer.		r	s	yr	j	v	g	me	Described by Coxe in 1817.
Fine Winter Baking Pear. C204. Syn. of Franc Real (Win.)									
Fingal's. D'45,333,'57,565,'69,778. E'54,396,'59,422. F277. Syn. of Hampden									
Fin Or d'Ete. MagofH'43,131. Syn. of Fin									

Fin Or d'Ete. C180. Pr18. K'41,119. E'54,395,'59,421. D'57,573,'69,760. Syn. of Fine Gold (Sum.).									
Fin Or d'Hiver. Pr104. K'32,45,'41,123. GenF'33,197,'37,278. D'45,436,'57,574,'69,766. E'54,395,'59,421. T'75,546,'85,561,'97,702. Syn. of Franc Real (Win.).									
Fin Or d'Orleans. Pr65. K'32,152,'41,130. Syn. of Fine Gold									
Fin Or de September. Pr65. Syn. of Fine Gold (Sept.)									
Fin Or de September. K'41,120. Syn. of Fin Or (Sept.)									
Fin Or (Sept.). L. Syn. Fin Or de Septembre								m	Published by Kenrick, 1841, p. 120; not described.
Fitzwater. OH'89,83. AofH'90,173. HAJ'90,24. AgR'92,261. MoH'92,235. NJH'93,78. IllH'94,137. A'95,73. AHM244. Syn. Fitzwater Seedless.									Possibly same as Lawrence; see Transactions Ohio Horticultural Society, 1889, p. 83.
Fitzwater Seedless. AofH'90,173. IllH'92,173. Syn. of Fitzwater									
Flandre. L. Syns. Bell of Flanders, Beurre de Flanders, Compete de Flanders, Comte de Flanders, Comte de Flandre, Comte of Flanders, St. Jean Baptiste, St. Jean Baptiste d'Hiver.	Belg	obtp	l	yru	bmjg	s	g-vg	m	Originated by Dr. John Van Mons.
Flat Bergamot. IaB3. Gb. IndH'86,82. FGAofO'89,3. NebH'90,130. MeP'99,63. EFABC'00. Syn. Bergamot ploskui.	Rus								Said to be very hardy; not described.
Flat Butter. D'69,729. Syn. of Crassane									
Flat Pear. MagofH'47,110									Not described.
Fleming. IllH'96,194. [Probably a synonym of Lincoln.]									
Flemish. S92. L. Bul6,8. AHM244. Syns. Barnard, Belle de Flanders, Belle des Bois, Bergamotte de Flandre, Beurre Davy, Beurre de Bourgogne, Beurre de Deftinge, Buerre Deftinghorn, Buerre des Bois, Beurre Foidard, Beurre St. Amour, Buerre Spence (erroneously), Bosch, Boschier, Bosche Nouvelle, Boschpeer, Bosc Sire, Bosch Nouvelle, Brilliant, Brilliante, Davy, Feodale, Flemish Beauty, Fondante des Bois, Fondante du Bois, Gracieuse, Imperatrice de France, Imperatrice de la France, Josephine, La Belle de Flanders, Molle Bouche Nouvelle, Nouvelle Gague a Henze, Petersilie Peer, Poire Davy, Poire de Deftinge, Poire de Persil, Poire des Bois, Tougaret.	Belg	obtp	l	yrub	bjm	s	vg	me	Formerly a very popular variety; less so now.
Flemish Beauty. Pr133. K'32,172'41,135. GenF'33,196. Cult'39,66. M'44,89,'47,91. D'45,386,'57,438,'69,760. G84. B'51,305,'83,369. Wg70. HovI,51. AgR'50,95. E'54,324,'59,337. Fi56. HMHS252. T'75,275,'85,293,'97,470. WnI,325,II,235,III,258. Syn. of Flemish.									
Flemish Bon Chretien. Pr206. GenF'37,278. K'41,161. D'45,430,'57,567,'69,761. Wg70. E'54,391,'59,418. H157. T'75,541,'85,555,'97,695. Syn. of Bon Chretien (Fl.)									
Flemish Sabine. MassH'47,69,'48,98									In Robert Manning's collection in 1847.
Fleur de Guignes. Pr138. K'32,131. D'45,545,'57,542,'69,856. E'54,383,'59,350. F282. Syn. of Skinless.									
Fleur de Mars. D'69,684. Syn. of Delbecq									
Fleur de Neige. B'51,316. D'57,500,'69,782. F280. E'59,384. FGAofO'72,14. T'75,546,'85,561'97,702. Syn. of Henri Van Mons.									
Fleurusienne. R. Syn. Belle Fleurusienne (Bivort)			m		m		vg		Published in Magazine of Horticulture, 1854, p. 235.
Flon. L. Syn. Beurre Flon	Fr	oblp	l	yr	djm	sp		m	Originated near Angers, France, in 1852.
Flon Aine. R. Syns. Doyenne Flon Aine, Madame Flon Aine									In the experimental orchard at Agassiz, B. C.
Florent Scouman. MagofH'60,219. D'69,762. Syn. of Scouman									
Florida Bartlett. MichSB30		rov	l	y	j	sp	g	l	On trial at Michigan substation; from Stark Bros.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Florimonde. F210,277. Syn. of Diel.									
Florimond Parent. D'57,500,'69,762. F280. E'59,384. T'75,546,'85,561,'97,702. Syn. of Parent.									
Flowered Autumn Muscat. Pr129. Syn. of Muscat Fleuri.									
Flowered Muscat. Pr12. K'41,118. Syn. of Muscat Fleuri									
Flower of Guigne. Pr138. Syn. of Skinless.									
Fondante. Pr134. K'32,185,'41,153. GenF'33,197. D'45,344,'57,582,'69,863. E'54,384 '59,410. F282. Syn. of Franc Real (Sum.)									
Fondante Abbrett. F280. Syn.of Abbret.									
Fondante Agreeable. MassH'53,18. MagofH'54,483. D'57,499 '69,762. F280. E'59,383. T'75,546,'85,561,'97,701. Syn. of Agreeable.									
Fondante Charneuse. F283. Syn. of Brabant.									
Fondante d'Albret. D'57,535,'69,762. Syn. of Albret (Fon.)									
Fondante d' Automne. Pr198. K'41,135. D'45,387,'57,439,'69,762. Cole158. B'51,304, '83,366, HovI,41. Wg66. AgR'53,282,'54,243,251,'62,179. E'54,312,'59,325. WHRI, 130. H157. F194. A'62,66,68. T'75,546,'85,561,'97,702. Syn. of Lucrative.									
Fondante de Bihoul. B'83,380. NYC'90. E&B'94. EFABC'00. Syn. of Bihoul.									
Fondante de Bois. MHSC'82,58. FGAofO'83,222. Syn. Holzfarbige Butterbirne.	Rus.?								Obtained from Warsaw, where it is hardy.
Fondante de Brest. Pr65. K'32,127. F280. Syn. of Brest.									
Fondante de Charneuse. E'54,368. H158. F283. MichH'74,28. Syn. of Brabant.									
Fondante de Cherneuse. K'41,170. Syn. of Brabant.									
Fondante de Cuerne. MagofH'57,260. D'69,763. Syn. of Cuerne.									
Fondante d' Ete. Pr148. Syn. of Summer Melting.									
Fondante d' Ingendal. MagofH'57,261. D'69,763. Syn. of Ingendal									
Fondante de la Maitre d' Ecole. D'69,764. Syn. of Maitre.									
Fondante de Lavnille. F280. Syn. of Lavnille.									
Fondante Delbecq. D'69,684. Syn. of Delbecq.									
Fondante de Ledeberg. EFABC'00. Syn. of Ledeberg.									
Fondante de Malines. MagofH'48,209,'51,66,'57,160. Hort'51,113,'58,498,'72,38. B'51,316. E'54,368,'59,383. AgR'54,245,'56,405. D'57,499,'69,764. H158. F280. T'75,275,'85,293,'97,470. Syn. of Malines (Fondante).									
Fondante de Malines (Esperin). E'51,368,'59,383. Syn. of Malines (Fondante)									
Fondante de Maubege. D'69,762. Syn. of Lucrative.									
Fondante de Millat. F280. Syn. of Serrurier.									
Fondante de Millot. MassH'51,189. MagofH'53,102. D'57,543,'69,854. F282. T'85,297. Syn. of Serrurier.									
Fondante de Mons. GenF'33,197. K'41,169. D'45,444.'57,532,'69,829. E'54,380,'59, 403. F254,281. Syn. of Passe Colmar.									
Fondante de Nees. D'69,764. Syn. of Nees.									
Fondante de Noel. AgR'54,245. MagofH'55,267. D'57,499,'69,764. F280. E'59, 359. T'75,288,'85,306,'97,479. WnI,333,II,342. EFABC'00. Syn. of Noel.									

Fondante de November. MagofH'43,131. Syn. of November									
Fondante de Panisel. Pr101. K'32,196,'41,164. GenF'33,197,'37,278. D'45,444,'57, 532. E'54,380,'59,403. Syn. of Passe Colmar.									
Fondante de Rome. D'69,696. Syn. of Romian									
Fondante des Bois. Pr212. K'32,172. Syn. of Flemish									
Fondante des Charneuse. K'41,144. AgR'56,405. D'57,494,'69,747. H158. F283. E'59,379. T'75,546,'85,561,'97,702. B'83,330. Syn. of Brabant.									
Fondante de Septembre. Hort'60,68	Belg								Originated by Dr. John Van Mons.
Fondante des Pres. MagofH'54,84. Hort'54,80	Belg		m				g		Originated by Dr. John Van Mons.
Fondante des Pres. MassH'53,19. D'57,500,'69,764. F280. E'59,383. T'75,546,'85, 561,'97,702. Syn. of Des Pres.									
Fondante de Thirriott. HAJ'88,74. AofH'92,277. CanExFR'05,431, Syn. of Thirriott.									
Fondante du Bois. GenF'33,196. MagofH'40,391. K'41,161. D'45,435. E'54,395. H157. AgR'56,282.	Eur	obo	m	gy				vl	
Fondante du Bois. E'59,330. AgR'62,180. Syn. of Anjou									
Fondante du Bois. Pr133. GenF'33,196. MassH'43,29. D'45,386,'57,438,'69,760. HovI,51. F201 E'59,337. Syn. of Flemish.									
Fondante du Bois.(incorrectly). D'45,401,'57,526,'69,821. Syn. of Niell									
Fondante du Comice. E'59,379. Syn. of Brabant									
Fondante du Comice. MagofH'51,550. D'69,764. Hort'64,53. T'75,546,'85,561,'97, 702. Syn of Comice (Fondante).									
Fondante du Comice Angers. D'57,499. F280. Syn of Comice (Fondante)									
Fondante du Panisel. EFABC'00. Syn. of Panisel									
Fondante Fougere. EFABC'00. Syn. of Fougiere									
Fondante Grise. K'41,170									Published by Kenrick; not described.
Fondante Musque. GenF'37,277. Syn. of Cuisse Madame									
Fondante Musque. DomEncIV,186. Pr28. K'32,127. D'45,346,'57,573,'69,158. E'54,399,'59,429. F280. Syn. of Summer Thorn.									
Fondante Noel. F276. Syn. of Noel									
Fondante Pariselle. MagofH'53,299. D'57,487,'69,733. F279. Syn. of Hardenpont (Belg.)									
Fondante Pariselle du Cornice Horticule. E'54,361,'59,376. Syn of Hardenpont (Belg.)									
Fondante Rouge. MagofH'43,131,'52,151			s	r					A small red pear covered with black blotches.
Fondante Serrurier de Millot. E'59,383. D'69,854. Syn. of Serrurier									
Fondante Thirriot. GarM'72,27. Syn. of Thirriot									
Fondante Van Mons. GenF'33,196. Cult'39,66. K'41,144. D'45,387,'57,499'69,764. MagofH'46,280. E'54,368,'59,383. H157. F280. T'75,546,'85,561'97,702.	Belg	r	ms	y	jm	s	g	m	Raised by Dr. John Van Mons; introduced by Robert Manning.
Fontarabie. WHRI,65. Syn. of Gilogil									
Fontarabie acure. D'69,772. Syn. of Gilogil									
Fontenay. Bul6. Syns. Belle d'Esquermes, DeFontenay Vendee, Fontenay Jalousie, Fontenay Vendee, Jalousie de Fontenay, Jalousie de Fontenay Vendee, Jalousie Fontenay Vendee.	Fr	oblp	m	ygru	bmj	v	vg	m	Tree an early and abundant bearer.
Fontenay. T'97,702. Syn. of Gray Winter									
Fontenay Jalousie. T'85,294,'97,702. Syn. of Fontenay									
Fontenay Vendee. L. Syn. of Fontenay									
Foote. L. Syn. Foote's Seckel	Mass	obtp	s	yberu	djm	sv	vg	me	First exhibited in 1868 as a Seckel Seedling.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Foote Aremberg. R. Syn. Foote's Aremberg	Mass								Raised by Mr. Foote, of Williamstown, Mass., from seed of Aremberg.
Foote's Aremberg. A'69,100. Syn. of Foot Aremberg									
Foote's Seckel. A'69,99,'75,119. D'69,765. Hort'70,62. MassH'74,158. AgR'75,379 T'75,546,'85,56,'97,702. Syn. of Foote.									
Foote's White Seckel. MassH'74,158. Syn of White Seckel									
Forelle. Pr 130 K'32,173,'45,127. GenF'33,196. MagofH'37,49,'47,339. Cult'39,66. D'45,389,'57,500'69,765. Cole170. B'51,305. Wg70. E'54,368,'59,383. F280. Ill. H'63,22. T'75,263,85,561,'97,702. WnI,333,II,342. MVHS'83,131. Syns. Aux Traites, Corail, Forellen-birne, German Trout, German Trout Pear, Grain de Corail, Graine de Coraile, Grave de Corail, K. L. Forelle, Petit Corail, Poire Truite Trout Pear.	Ger	oblp		gyrc	bgru	v	g	l	Beautifully spotted; hence the synonym Trout Pear.
Forellen-birne. Pr130. K'32,173,'41,127. GenF'33,196. D'45,389'57,500'69,765. E'54,368,'59,383. Syn. of Forelle									
Foret. R. Syn. Foret (Poire de)									Published in Magazine of Horticulture.
Foret (Poire de). MagofH'43,131. Syn. of Foret									
Forme de Bergamotte Crassane. F280. D'69,766. Syn. of Crassane (Bergamot)									
Forme de Delices. D'45,388,'57,573,'69,766. E'54,395,'59,421. H158. T'75,546,'85,562, '97,702. Syn. of Delices.									
Forme de Marie Louise. K'32,173,'41,148. GenF'33,197. D'45,399,'57,522,'68,813. HovII,37. E'54,377.'59,398. F281. Syn. of Marie Louise.									
Forme de Rousselet. MagofH'43,131									Not described.
Forme des Delices. GenF'33,196. Cult'39,66. MagofH'50,296. A'54,238. Syn. of Delices.									
Forme Urbaniste. MassH'45,88. MagofH'50,296. A'54,238									Exhibited by Robert Manning in 1845.
Forniquet. D'69,851. Syn. of Salviata									
Fortier. R. Syn. President Fortier									In the experimental orchard at Agassiz, B. C.
Fortune. MassH'66,43	Mass. ?								Raised by Dr. S. A. Shurtleff. Exhibited at meeting of Massachusetts Horticultural Society, 1866.
Fortune Boisselot. NYC'90. Syn. of Boisselot									
Fortunee. D'45,436,'57,573,'69,766. B'51,316. E'54,395,'59,421. H158. F280. IllH'69, 156. T'75,547,'85,562,'97,702. EFABC'00. Syns. Bergamotte Fortunee, Beurre de Remme, Beurre Fortune, Beurre Fortunee, Episcopal, Fortune, Fortunee Belge, Fortunee de Printemps, Fortunee de Remme, La Fortunee de Paris, La Fortunee de Parmentier, Surpasse Fortunee.	Fr. ?	rob	ms	gyru	m	s	g	l	Raised by M. Parmentier, of Enghien, France.
Fortunee. Cult'39,66. Syn. of Dundas									

Fortunee Belge. MagofH'40,46. Syn. of Fortunee.									
Fortunee Boisselot. E&B'94. EFABC'00. Syn. of Boisselot.									
Fortunee de Printemps. AJofHIX,377. Syn. of Fortunee.									
Fortunee de Remme. D'69,766. Syn. of Fortunee.									
40 Ounce. WPr12. Pr118. K'41,128. D'45,568,'69,716. Syn. of Catillac.									
Foster. FGAofO'69,44. Bul6. Syns. Foster's St. Michael, Foster Seckel		rov	m	y	co	s	g	me	
Foster's St. Michael. MassH'44,61. Hort'49,457. A'54,238. E'54,395,'59,421. D'57, 573,'69,766. F273. T'75,547,'85,562,'97,702. Syn. of Foster.									
Foster Seckel. Bul6. Syn. of Foster.									
Fougiere. L. T'97,702. Syns. Beurre Fougiere, Fondante Fougere	Eur.	obo	m	gyru	gmj	s	g	m	From Manning's MS. Introduced by J. C. Lee.
Fourcroi. D'69,686. Syn. of Diel.									
Fourcroy. MagofH'38,457,'40,44. MassH'45,91. D'69,760. Syn. of Naples.									
Fourcroy Bouvier. HovI,77. Syn. of Diel.									
Fourcroy d'Hiver. F280. Syn. of Diel.									
Fourgnois. Cult'47,330.									Not described.
Fourth of July. IllH'96,205,215.									On trial at Illinois agricultural experiment stations.
Fowelle. MichH'76,143.									May be intended for Forelle.
Fowler. MoH'96,57. IllH'98,187. BBL.									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Fowle's Large. MassH'45,88.									Exhibited by Robert Manning in 1845.
Fox. A'75,38. L. AHM245. Syns. B. S. Fox, Fox S. B., Fox Seedling	Cal.	obtp.	l	yru	djm	s		m	Originated by B. S. Fox, of Santa Clara, Cal.
Fox No. 1. WNYH'89,159.									
Fox No. 7. WNYH'89,159.									
Fox No. 8. WNYH'89,159,'05,140.									
Fox S. B. IllH'96,204. Syn. of Fox									
Fox Seedling No. 11. GarM'72,280.									
Fox Seedling No. 17. GarM'72,280.									
Fox Seedling No. 22. MassH'75,119.									
Fox Seedling No. 41. A'75,66.									
Fox Seedling No. 52. MassH'77,79. A'77,42.									
Fox Seedling No. 58. A'81,66.									
Fox Seedling No. 60. FGAofO'74,12.									
Fox Seedling No. 62. GarM'72,280.									
Fox Seedling No. 64. MassH'77,79.									
Fox Seedling No. 65. GarM'72.280.									
Fox Seedling No. 66. A'77,42,'81,66.									
Fox Seedling No. 81. A'75,66.									
Fox Seedling No. 109. A'77,42,'81,66.									
Fox Seedling No. 111. GarM'72,183,280. FGAofO'74,12.									
Fox Seedling No. 150½. MassH'75,119.									
Fox Seedling No. 153. MassH'77,29.									
Fox Seedling No. 157. A'75,66. MassH'77,80.									
Fox Seedling No. 159. MassH'77,80.									
Fox Seedling No. 180. A'81,66.									
Fox Seedling No. 181. A'75,66.									
Fox Seedling No. 185. A'75,66.									
Fox Seedling No. 189. A'81,66.									
Fox Seedling No. 192. A'75,66.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Fox Seedling No. 196. A'75,66,'77,42									
Fox Seedling No. 197. A'75,66									
Fox Seedling No. 250. A'77,42									
Fox Seedling No. 253. MassH'77,80									
France Cannel. K'32,185,'41,153. Syn. of Franc Real (Sum.)									
Frances. MagofH'45,252,'49,43	Conn.								Originated by Governor Edwards, of Connecticut. Resembles Virgoulouse.
Franchepanne. WPr10. Syn. of Frangipane									
Franchimont. D'69,766	Fr.?	rob	s	yrru	jm	sp	g vg	m	
Franchepane. Pr49. K'32,136. Cult'39,66. D'69,767. Syn. of Frangipane									
Francis. MassH'66,43	Mass.								Originated by Dr. S. A. Shurtleff. Fruited in 1862.
Francis Borgia. AJofHVIII,228. A'75,68. Dap155. Syn. of Onondaga									
Francis Dana. MassH'77,80	Mass.	rp	m	yru					Shown by E. Stone, at meeting of Massachusetts Horticultural Society, 1877.
Francis the Second. MagofH'43,131									Not described.
Francois. F280. Syn. of Bergia									
Francois Bergia. D'69,766. Syn. of Bergia									
Francois Binot. EFABC'00. Syn. of Binot									
Franc Real. WPr12. Pr109. Syn. of Catillac									
Franc Real. Pr104. K'32,145,'41,123. GenF'33,197. D'45,436,'57,574,'69,766. E'54,'395,'59,421. EFABC'00. Syn. of Franc Real (Win.).									
Franc Real d'Ete. Pr134. K'32,185,'41,153. GenF'33,196. MagofH'43,367. D'45,344,'57,582,'69,863. E'54,384,'59,410. F282. T'75,547,'85,562,'97,702. Syn. of Franc Real (Sum.).									
Franc Real d'Hiver. GenF'33,197,'37,278. D'45,436,'57,574,'69,766. A'54,238. E'54 395,'59,421. H159. T'75,547,'85,562,'97,702. Syn. of Franc Real (Win.).									
Franc Real (Sum.). L. Syns. Bergamotte d'Ete ou Milan Blanc, Beurre Blanc, Beurre d'Ete, Coule Soif, France Cannel, Franc Real d'Ete, Fondante, Great Mouthwater, Green Chisel, Green Sugar, Gros Micet d'Ete, Gros Mouille Bouche, Hativeau Blanc, Koop's Fondante, Milan Blanc, Milan de la Beurriere, Mouille Bouche, Preble's Beurre, Royale, Summer Bergamot, Summer Franc Real.	Fr.?	obo	m	yg	b	s	g	me	Origin supposed to be France.
Franc Real (Win.) L. Syns. Fine Gold of Winter, Fin Or d'Hiver, Fine Winter Baking Pear, Franc Real, Franc Real d'Hiver, Frank Royal, Golden End of Winter, Gros Micet, Winter Franc Real.		rp	m	ybru	ce			vl	Only recommended for the kitchen.
Frangipane. C205. Pr49. K'32,136,'41,121. H159. D'69,767. Syns. Franchepanne, Franchipane, Jasmin.		rp	s	yru	jm	s	g	m	An old and probably obsolete variety.
Frankford. MagofH'57,108. Hort'57,111. D'57,501,'69,703. F223. E'59,384. CGenIX,190. T'75,547,'85,562,'97,702. Syn. of Bleecker.									
Franklin. E'54,373,'59,384,393. D'69,791. Syn. of Johonnot									
Franklin. D'69,850. Syn. of Saint Germain									

Frank Royal. Pr104. Syn. of Franc Real (Win.)									
Franzosische Rumelbirne. D'45,428,'57,565,'69,700. Syn. of Heri									
Fraser or Butter Pear. D'69,831. Syn. of Penn									
Frauenschenkel. D'45,337,'57,514,'69,758. Syn. of Jargonelle (Eng.)									
Frazer. Hort'63,58. Syn. of Penn									
Fred Baudry. IllH'96,204,'02,220. E&B'02. AHM234. Syn. of Baudry									
Fred. Clapp. CanH'87,5. A'79,96. IllH'96,178. Bul6. Syns. Clapp's No. 22, Frederick Clapp.	Mass	robop	ml	y	djm	vp	g	m	Raised by Lemuel Clapp from seed of Urbaniste.
Frederic de Wurtemburg. K'32,173,'41,145. MagofH'45,174,'51,509. D'45,390,'57,574 '69,767. Hort'72,347. Syn. of Wurtemburg.									
Frederick. R. Syn. Prince Frederick									Published in Magazine of Horticulture, 1843, p. 131.
Frederick Bremer. Cult'56,339. F273 Syn. of Bremer									
Frederick Clapp. MassH'76,94,'86,25. Dap148. WNYH'79,53,'81,20. FGAofO'79, 43. A'81,97,99. B'83,370. MichH'86,420. T'85,562. IllH'93,76,'95,55. AHM245. Syn. of Fred. Clapp.									
Frederick de Wurtemburg. E'54,368,'59,383. F280. Syn. of Wurtemburg									
Frederick Leclerc. F280. D'69,767. Syn of Leclerc (Frederick)									
Frederick Lelieur. D'69,727. Syn. of Lelieur (Comte)									
Frederic of Prussia. MagofH'37,48,'38,395,'50,296 A'54,239									This may be Wurtemburg.
Frederic of Wurtemburg. M'38,85,'44,72,'47,76. Syn. of Wurtemburg									
Frederick of Wurtemburg. MagofH'45,174,'51,509. D'45,390,'57,574'69,767. NAPC-'49 12. B'51,305. E'54,368,'59,383. AgR 56,380. F242. A'62,68. T'75,547,'85,562,'97, 702. Syn. of Wurtemburg.									
Frederika Bremer. MagofH'50,21,'51,551. Hort'50,417,496. B 51,316. E'54,369,'59, 384. H158. D'57,501,'69,767. Hof. A'64,68. CGenXXIII,288. T'75,547, 85,562, '97,703. MHSC'76,29. Syn. of Bremer.									
French Autumn Bergamot. Pr70. Syn. of Bergamot (Aut.)									
French Iron. MagofH'50,296. A'54,238									Rejected by Congress of Fruit Growers, 1849.
French Jargonelle. Pr154. WHRII,474. E'54,395,'59,421. H124. D'69,767. T'75, 549,'85,564,'97,706. Syn. of Jargonelle (Fr.).									
French Pound. L. Syns. Black Pear of Worcester, Great Rake Pear, Gros Rateau Gris, Parkinson's Warden, Poire d'Amour, Poire de Livre, Pound Pear.		t	l	gru	br			vl	Prince says this differs from either Pound or Catillac.
French St. Germain. WPr10				g	m			vl	An old and possibly obsolete variety.
French Winter. R. Syn. French Winter Virgalieu									Catalogued by Silas Wharton in 1824.
French Winter Virgalieu. SW. Syn. of French Winter									
Fresnel. R. Syns. Compete de Fresnel, Comte de Fresnel, Monsieur le Comte de Fresnel.									Published in Magazine of Horticulture, 1843, p. 131.
Friolet. Pr51. K'32,127. Syn. of Cassolette									
Froyennes. L. Syns. Delices de Frogmore, Delices de Froyennes, Poire delices de Froyennes.	Fr	ap	m		dmj	sp		l	From Revue Horticole.
Fruhe Rousselet. D'69,856. Syn. of Skinless									
Frys. R. Syn. Comptesse Clara Frys									Not described.
Fuller. [illegible] HAI'86. IllH'97,213. Syn. William Fuller	Ohio								Originated in Madison, Ohio.
Fullero. MHSC'86,82			l	g			vg	e	In Report of Montreal Horticultural Society, 1886, p. 82.
Fulton. Pr44. K'32,173,'41,145. MagofH'35,'39,'40,45. M'38,88'44,76,'47,77. D'45, 391,'57,501,'69,768. Cole164. HovII,17. B'51,305,'83,370. Wg70. NAPC'49,12. AgR'56,279,'59,266. E'54,323,'59,358. T'75,284,'85,302,'97,476.	Me	rob	ms	cru	bj		vg	m	Raised by Mrs. Fulton, of Topsham, Me., in 1828.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Fulvie. L. EFABC'00. Syns. Fulvie Gregoire, Nouvelle Fulvie	Belg	p	vl	ybru	mbj	sp		vl	Description from Annals of Pomology.
Fulvie Gregoire. D'69,822. Syn. of Fulvie.									
Funtovka. MHSC'82,59. FGAofO'83,223. Syn. of Pound									
Furnas. IndH'91,154. Syn. of Arnold									
Fusee d'Ete. D'69,767. Syn. of Jargonelle (Fr.)									
Gabrourelis. L. Syn. Gabrourelis Seedling	For								Published by Field, p. 280; not described.
Gabrourelis Seedling. F280. Syn. of Gabrourelis									
Gaillard. R. Syn. Ferdinand Gaillard		obtp	m	gy	tjm	s		ml	In the experimental orchard at Agassiz, B. C.
Gakovsk. Gb. MichH'92,166. MinnH'97,272. Syns. Gakovska, Gakovskaya, Gakovsky, No. 347.	Rus	p	sm	gy	b	v	p		Introduced from Russia in 1879.
Gakovska. IaH'85,321,382,'90,207. IndH'85,27 C&C'95. FGAofO'89,3. IaB3. NebH'89,55,'90,245. MeP'99,62. Syn. of Gakovsk.									
Gakovskaya. Gb. Syn. of Gakovsk									
Gakowskaja. IaH'80,61									Possibly the same as Gakovsk.
Galston. R. Syn. Galston Moor Fowl Egg		ovobo	ml	gyb			g	m	Published in Magazine of Horticulture, 1852, p. 152.
Galston Moor Fowl Egg. MagofH'52,152. Syn. of Galston									
Gambier. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar									
Gambier's Butterbirne. AofH'91,296. [Perhaps same as Passe Colmar.]									
Gans. NYC'90. A'91,124. C(O)HS'91,147. AgR'91,390. IllH'96,45,178. EFABC'00. Syn. Gans Seedling.	Ohio			y			vg	me	Found on his farm by Joseph Gans, in 1871.
Gans Seedling. E&B'02. Syn. of Gans									
Gansel Bergamot. L. Syns. Bergamot Ganzel's, Bergamotte Gansel's, Bonne Rouge, Broca's Bergamot, Diamant, Dickson, Dixon, Gansel's Bergamont, Gansel's Bergamotte, Gansell's Bergamot, Gurle's Beurre, Ives Bergamot, Ives's Bergamot, Staunton.	Eng	robo	l	ybru	mj	sp	vg	me	Raised at Donneland Hall by General Gansel.
Gansel's Bergamot. Pr74. K'32,135,'41,127. GenF'33,196,'37,277. M'38,81,'44,68'47,71 Cult'39,66. D'45,366,'57,457. Cole158. E'54,369. NWFG'55,40. H159. A'62,68. T'75,284,'85,302,'97,476. Syn. of Gansel Bergamot.									
Gansel's Bergamotte. MagofH'48,200. E'54,369,'59,384. H159. B'83,381 D'69,769. T'85,302. Syn. of Gansel Bergamot.									
Gansel Late. L. Syns. Gansel's Late Bergamot, Gansel's Late Bergamotte, Late Gansel, Late Gansel's Bergamot.	Eng	rob		gru	jgm	spv	g-vg	l	Raised by Mr. Williams, of Pitmaston, England.
Gansel's Late Bergamot. E'54,369. F280. Syn. of Gansel Late									
Gansel's Late Bergamotte. E'54,369,'59,385. MagofH'57,158. D'57,502,'69,769. T'75,547,'85,562,'97,703. Syn. of Gansel Late.									
Gansell's Bergamot. HovII,77. Syn. of Gansel Bergamot									
Gansel Seckel. MichSB27. MichB187,194 Syn. Gansel's Seckel	Eng	of	ms	yru	cojm	vp	vg	m	Raised by Mr. Williams, of Pitmaston, England.

Gansel's Seckel. D'57,502,'69,770. F280. E'59,585. T'75,547,'85,562,'97,703. B'83,381. ExB'94. AHM246. Syn. of Gansel Seckel.									
Gantoise. R. Syn. Bergamot la Gantoise									In the experimental orchard at Agassiz, B. C.
Ganyard. R. Syns. Beurre Rome Ganyard, Beurre Rom Ganjard									In the experimental orchard at Agassiz, B. C.
Garber. PaB18. CanH'79,94. GaH'85,54,'92,42. HAJ'90,23. AofH'90,202. IllH'92,223. GHM&S'90,94. T'97,702. MoH'93,223,225. OH'98,8. Bul6,8. AHM247. IndH'03,257. Syn. Garber's Hybrid.	Pa								An Oriental hybrid of the Kieffer type.
Garber's Hybrid. IndH'79,49,'92,93. Ha255. Bl229. IaH'93,199. Syn. of Garber.									
Garde d'Ecosse. Fr111. D'45,436,'57,574,'69,772. E'54,395,'59,422. Syn. of Gilogil.									
Garde Ecosse. Fr111. D'69,772. Syn. of Gilogil									
Garden. L. Syns. Garden Pear Poire du Jardin		rclo	l	gyr	cog	s		l	
Garden Pear. C195. Th187. H181. D'69,770. Syn. of Garden									
Gardette. L. Syn. Catharine Gardette	Pa	rcbo	m	y	coj	s	g	me	Raised by Dr. W. D. Brinckle, of Philadelphia, Pa
Gardner. MagofH'78,506									Not described.
Gergonelle. SW. Syn. of Jargonelle (Eng.)									
Garner or Gardner. Fr83. K'41,121. D'69,880. Syn. of White Doyenne									
Garnier. F278,280. T'97,703. Syn. Bezy Garnier		p			brj	v		vl	
Garnons. GenF'55,197. MagofH'40,391,'43,126,'51,473. K'41,161		cbl	l	gy	b		g	l	
Garnston. MagofH'38,395,'70,296. A'54,238									Rejected by the Congress of Fruit Growers, 1849.
Gaskovka. MinnH'96,226	Rus?								Being tested at Windom experiment station, Minnesota.
Gastelier. D'69,696 Syn. of Rance									
Gaston. R. Syn. Gaston du Puis									In experimental orchard at Agassiz, B. C.
Gaston du Puis. EFABC'00. Syn. of Gaston									
Gaudry. D'69,670. Syn. Bergamotte Gaudry	For	rov	s	gyru	gco	v	p	m	
Gay Doyenne. F245. Syn. of Gray Doyenne									
Geant. F280	For								Not described.
Gedeon Paridant. MagofH'52,419. Hort'53,66. AgR'56,330. D'57,503,'69,747. A'54,157. T'75,547,'85,562,'97,703. Syn. of Aumale.									
Geer. R. Syn. Geer's Seedling	Oreg								Originated with R. C. Geer, of Oregon.
Geer's Seedling. [illegible] Syn. of Geer									
Gelbe. R. Syn. Gelbe summer Butterbirne									Published in Magazine of Horticulture, 1843, p. 130.
Gelbe Summer Butterbirne. MagofH'43,130. Syn. of Gelbe									
Gendebien. D'69,770. Syn. of Gendesheim									
Gendesheim. Fr201. K'32,174,'41,145. MagofH'45,332. D'45,392,'57,574,'69,770. A'54,238. E'54,395,'59,421. H159. F280. T'75,547,'85,562,'97,703. Syns. Gendebien, Gendesheim, Verlaine, Verlaine d'Ete.	Fl	obtp	s	gyru	gb	p	g-p	m	
Gendersheim. GenF'55,197. CultI'59,66. Syn. of Gendesheim									
Gendron. L. EFABC'00. Syns. Beurre Gendron, Poire Gendron	Eur.	oblp	l	ybr	jger.	sv		vl	A fine culinary variety
General Pemberton. MassH'64,41. A'67,156. AHort A'68,80. D'69,831. Syn. of Pemberton.									
General Bonchamp. MassH'72,92	Eur.?	oblp	l	y	mj	s	vg	m	A fine newly introduced variety.
General Bosquet. MagofH'57,291. Hort'57,516. D'57,502,'69,771. F280. T'75,547,'85,562,'97,703. Syn. of Bosquet.									
General Canrobert. MagofH'57,301. D'57,502,'69,770. F280. MassH'71,39. T'75,547,'85,562,'97,703. Syn. of Canrobert.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
General de Bouchamp. Dap176. Syn. of Bouchamp									
General de Lamoriciere. F280. Syn. of Lamoriciere									
General de Lourmel. MagofH'57,261. Hort'57,516. D'57,503,'69,770. E'59,385. F. 280. T'75,547,'85,562,'97,703. Syn. of Lourmel.									
General Dutilleul. AgR'54,245. Hort'59,491. F280. D'69,770. Syn. of Dutilleul									
Gen. Dutilleul. Hort'72,130. Syn. of Dutilleul									
General Duvivier. D'69,688. AofH'91,296. Syn. of Duvivier									
Gen. Grant. MassH'64,41,'68,7. A'67,156,'69,46. Syn. of Grant									
Gen. Kearney. MassH'66,43	Mass								Raised by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1862.
General Lamoriciere. MagofH'52,296. E'54,374,'59,395. D'57,502,'69,771. Hort'61, 316. T'75,547,'85,562,'97,703 Syn. of Lamoriciere.									
General Negley. FGAofO'72,14,74,'77,23	Ont.?								Fruited by Rev. R. Burnet, of Ontario, in 1872.
General Obdam. K'41,170. MagofH'42,250. Syn. of Obdam									
Gen. Sherman. MassH'66,43	Mass.	t	m		mj			ml	Raised by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1865.
General Taylor. MagofH'54,75,269. WHRIV56. D'57,503,'69,771. F273. E'59,385. T'75,547,'85,562,'97,703. Hort'75,244. A'77,50. B'83,381. Syns. Homewood, Keyports.	Md.	obtp	m	yru	cojm	s	g vg	m	Introduced by L. N. Rogers, of Baltimore, Md.
General Todleben. D'69,771. FGAofO'82,81. T'85,562. Syn. of Totleben									
Gen. Todtleben. Hort'72,130. CanH'81,38. MoH'87,96. Syn. of Totleben									
General Totleben. AJofHV287. Hort'66,138. AHortA'70,77. D'69,771. T'75, 547,'85,562,'97,703. B'83,381. EFABC'00. Syn. of Totleben									
Gen. Tottleben. MagofH'59,70. Hort'70,355. Syn. of Totleben									
General Warren. A'81,98. MassH'82,24,'86,27. Syn. of Brabant									
Genesee. D'69,859. Syn. of Stevens									
Genesee Virgalieu. A'69,53									Mr. Hoag spoke of this as a valuable early variety.
Gens. L. T'97,703. Syn. Beurre Gens	Belg.	obop	m	yrru	djm	sv	vg	m	Tree vigorous and fruitful.
George Augustus. MassH'72,91	Mass.							l	Raised by Francis Dana. Much like Winter Nelis.
Georges. L. Syn. Saint Georges	For.								Published by Field, p. 282; not described.
Gerando. MagofH'57,161. D'69,771. Syn. Poire Gerando	Eur.	robtp	ml	yerru	cogb	sav	g	m	
Gerardin. D'57,503,'69,772. E'59,385. T'75,547,'85,562,'97,703. Syns. Gerardine, Girardin, Girardon, La Girardin.	Eur.	r	m	yrru	cobg	a	g p		
Gerardine. D'69,772. Syn. of Gerardin									
Gerhard. R. Syn. Gerhard's Butter									Handsome, good, productive. See PaFGS, 1871, p. 66.

Gerhard's Butter. PaFS'71,66. Syn. of Gerhard									
German Baker. D'45,448. Syn. of Tonneau									
Germain (Prince). L. Syns. Brown St. Germain, New St. Germain, Prince's St. Germain.	N. Y.	obop	m	gbru	jm	sv	vg	vl	Originated with William R. Prince, of Flushing, Long Island, N. Y.
126 **Germain** (Van Mons). L. Syn. Saint Germain Van Mons	Belg.	robop	ms	gy	bmj	s	g	m	Originated with Dr. John Van Mons.
German Baker. E'54,334,'59,346. D'69,835. Syn. of Pound									
German Bergamot. EFABC'00. CanExFR'05,430.									In the experimental orchard at Agassiz, B. C.
German Muscadel. DomEncIV,180. Th187. Syn. of German Muscat									
German Muscat. C201. SW. Pr81. K'32,145,'41,126. MagofH'54,138. D'69,772. Syns. Almain, Colmar Boise, German Muscadel, Muscat Allemand, Muscat Allemande, Muscat d'Allemagne, Muscat Lallemand, Muscat l'Aleman, Muscat l'Alleman, Muscat l'Allemand, Muscat of Germany.	Eur ?	obtp	m	yru	coj	sa	g	l	Described by La Quintinge in 1690.
Germantown. Hort'60,448									Exhibited at meeting of Louisville (Ky.) Horticultural Society by J. Stevens.
German Trout Pear. Wn133,II,342. Syn. of Forelle									
Gerry. MagofH'40,43	Conn								Originated by Governor Edwards at New Haven, Conn.
Ghelin. L. Syns. Beurre de Ghelin, Beurre de Fromentel, Beurre Fromentel	Belg.	robl	l	yru	dj	s	g	l	Raised near Mons by M. Fontaine de Ghelin.
Ghislain. AgR'54,243. Bul6,8. AHM247. Syns. Duck Monarch, Quinnipiac, St. Galen, St. Ghislain, Saint Ghislein, Saint Ghislain, St. Michael's.	Belg.	p	m	y	bj	v	g-vg	m	
Ghryrey. R. Syn. Schahin Ghryrey	Eur								Said to be from the Crimea.
Gibson. MagofH'37,14. K'41,134. D'45,349,'57,451,'69,660. MassH'47,52. Cole161. B'51,302. Hov1,97. Syn. of Andrews.									
Gideon Paridant. MagofH'52,419. Hort'53,66. E'54,369,'59,385. MassH'56,19. H159. F280. T'85,500. Syn. of Aumale.									
Giffard. Hort'75,119. S89. T'85,268,'97,452. IllH'93,89. Bul6,8. AHM247. Syns. Beurre Giffard, Beurre Giffart, Beurre Gifford, Giffart, Poire Giffard.	Fr.	p	m	gyr	mj	v	vg	me	Originated by M. Giffard, of Angers, France.
Giffart. MagofH'48,111. D'69,689. Syn. of Giffard									
Gift from Malines. Pr135. Syn. of Passe Colmar									
Gilbert. R. Syn. President Gilbert							vg		Ellwanger & Barry represent it as very good.
Gilded. R. Syns. Beurre dore, Gilded Butter			ml	y			vg	ml	May possibly be Bilboa, which has a gilded skin.
Gilded Butter. DomEncIV,182. K'32,162. Syn. of Gilded									
Gile-o-gile. Pr111. K'41,130. D'45,436,'57,574,'69,772. E'54,395,'59,422. H160. Syn. of Gilogil.									
Gilles. R. Syn. Beurre Gilles									In the experimental orchard at Agassiz, B. C.
Gillette longue. D'69,804. Syn. of Blanquet (Long Stem)									
Gillogille. Pr111. Syn. of Gilogil									
Gilogil. MagofH'39,395. Colt'39. K'41,130. D'45,436,'57,574,'69,772. E'54,395,'59,422. F280. T'75,547,'85,562,'97,703. Syns. Bellegarde, Bergamotte Geerard, Beurre Geerard, Caree d'Hiver, Dagobert, Fontarabie, Fontarabie acure, Garde d'Ecosse, Garde Ecosse, Gile-o-gile, Gillogille, Gilot, Girogille, Gobert, Gros Franc Real, Gros Gabert, Gros Gilot, Gros Guy Grilland, Jilogil, Livre de Burgoyne, Pequini, Poire a Gobert, Poire de 16 Ounces, Ris de Loup, Teton de Venus.	Fr.	r	l	rru	ber			vl	Large and showy, but fit only for cooking.
Gilot. D'69,772. Syn. of Gilogil									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Girardin. MassH'46,151. A'54,238. F280. D'69,772. Syn. of Gerardin									
Girardon. D'69,772. Syn. of Gerardin									
Girogille. D'69,772. Syn. of Gilogil									
Gisambert. D'69,710. Syn. of Brown									
Giusti. R. Syn. Beurre del Giusti									Published in Annals of Horticulture, 1892, p. 276.
Glace. L. Syn. Glace d'Hiver	For								Not described.
Glace d'Hiver. F280. Syn. of Glace									
Gleck. CanExFR'96,136									In the experimental orchard at Agassiz, B. C.
Gliva. IaH'80,61									May be Kurskaya.
Gliva Kurskaya. Gb. IaH'80,61. CanExFR'95,391'96,446. EFABC'00. Syn. of Kurskaya.									
Gliva Medovaya (Honigbirne). Gb. Syn. of Honey (Russ.)									
Gliva Otschen Sotchnaya. Gb. Syn. of Juicy Gliva									
Gloria. MagofH'37,395. MassH'37,37. GenF'37,278. Syn. Colmar d'Hiver		rp		yg		m	vg		Mr. Lyon thought this might be Winter Nelis.
Glorie de Binche. MagofH'55'151									Not described.
Glorie de Cambroul. F280. Syn. of Cambroul									
Glorie de l'Empereur. F281. D'69,819. Syn. of Napoleon									
Glory of Cambrone. Cult'47,340. MassH'57,189. E'59,385. D'69,772. Syn. of Cambrone.									
Glot Morceau. GenF'37,278. Syn. of Glout Morceau									
Glou-Morceau. D'45,437,'57,503,'69,773. F280. T'85,306. EFABC'00. Syn. of Glout Morceau.									
Glou Morceau de Cambron. D'69,773. Syn. of Glout Morceau									
Glout Morceau. K'32,194,' 1,166. GenF'33,197. M'38,94. Cult'39,66. B'51,310,'83,376. Wg70. AgR'50,95,'53,280,'62,185. Hov1,5. E'54,325,'59,339. A'62,68. D'69,773. Bul6,8. AHM247. Syns. Beurre d'Ardenpont, Beurre d'Aremberg, Beurre de Cambron, Beurre d'Hardenpont, Beurre d'Hardenpont de Cambron, Beurre d'Hiver Nouvelle, Beurre de Kent, Beurre Lambard, Colmar d'Hiver, D'Aremberg, Glot Morceau, Glou Morceau, Glou Morceau de Cambron, Gloux Morceau, Got Luc de Cambron, Goulee Morceau, Goulone Morceau de Chambron, Hardenpont, Hardempont, Hardenpont d'Hiver, Hardenpont's Winter Butterbirne, Kronprinz Ferdinand, Kronprinz Von Oesterich, Langlier's Victoria, Linden d'Automne, Potts, Roi de Wurtemburg, Stuck, Trimble, Victoria, Wolaston, Wollaston, Woolaston.	Fl	ovobtp	l	gyb	gbm	sa	g-vg	l	Originated at Tournay with M. D'Ardenpont.
Gloux Morceau. K'32,194. GenF'33,197,'37,278. D'45,437,'57,503,'69,773. E'54,325,'59,339. F280. T'85,306. Syn. of Glout Morceau.									
Gloward. F280	For								Not described.
Gluetsbirne. AofH'91,296									Introduced in 1891.
Glymes. L. Syn. Laure de Glymes	Belg	rov	ms	yru	cob	va	g	m	Raised by Dr. John Van Mons.

Goat-herd. EFABC'00. CanExFR'01,480.		ap	s	grru	jb	s		m	In the experimental orchard at Agassiz, B. C.
Gobbelschroy. R. Syn. Van Gobbelschroy									Published in Magazine of Horticulture, 1855, p. 146.
Gobert. D'69,772. Syn. of Gilogil									
Godbey. BBL									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Goes. L. Syn. Philippe Goes	Belg	rp	sm	ybru	mj	vp	g-vg	me	Said to resemble Mello.
Golconda. R. Syns. Golconda Nova, Golcondi Nova									Published in Magazine of Horticulture, 1846, p. 367.
Golconda Nova. MagofH'46,367. Syn. of Golconda									
Golcondi Nova. MagofH'52,470. Syn. of Golconda									
Golden Bell. MassH'65,44,'66,43	Mass								Grown by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1862.
Golden Beurre. Pr49. K'32,135. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238. Syn. of Brown.									
Golden Beurre of Bilboa. K'32,177,'41,145. GenF'37,277. M'38,80,'44,70,'47,75. D'45,362,'57,461,'69,773. Cole157. Wg70. HovI,99. Hort'47,174,'73,278. AgR'53,280,'54,250. E'54,326,'59,338. T'75,275,'85,293,'97,470. B'83,378. Syn. of Bilboa.									
Golden Beurre (of some English collections). HovI,99. Hort'73,22. Syn. of Bilboa.									
Golden Bilboa. AgR'50,94. Syn. of Bilboa									
Golden End of Winter. Pr101. D'69,766. Syn. of Franc Real (Win.)									
Golden Knap. MagofH'43,131. Syn. of Knap									
Golden Knap Bogmiln. MagofH'43,131. Syn. of Bogmiln									
Golden Russet. IaB31. Huc'01, Syns. Canner's Japan, Japan Golden, Japan Golden Russet, Japan Russet, Taihe.									An Oriental variety; handsome but poor in quality.
Gold of Summer. MagofH'51,262. Syn. of Fine Gold (Sum.)									
Gold Pear. MoH'87,96	Eur.								Cultivated in Montgomery County, Missouri.
Gommery. L. Syn. Beurre de Gommery	For								Published by Field, p. 278.
Goodale. MassH'65,44,'66,46,'67,37,'73,97. AHortA'68,75,80,'70,77. Hort'69,372,'73,57,'74,540. D'69,773. HHH'71,152. MeP'73,44,'75,114,'89,49. AJofH11,243. T'75,547,'85,562,'97,703. MichH'75,60. Syns. Goodale's Seedling, Saco.	Me	oblp	l	yeru	jmg	svp	vg	m	Raised from seed by Enoch Goodale, of Saco, Me.
Goodale's Seedling. D'69,773. Syn. of Goodale									
Good Christian of Spain. C209. Pr'93. D'69,858. Syn. of Spanish									
Good Christian of Winter. C203. Pr92. D'69,884. Syn. of Bon Chretien (Win.)									
Good Grey. C185. Pr34. H162. Syn. of Grise-Bonne									
Good Louis. Pr97. Syn. of Louise Bonne									
Good Louise. Pr97. K'32,174,'41,146. Syn. of Louise Bonne									
Gore's Heathcot. Pr143. K'32,174,'41,146. GenF'38,85. D'45,394,'57,507,'69,780. MagofH'48,102. HovI,89. E'54,326,'59,389. H165. F280. A'62,68. T'85,293,'97,703. Syn. of Heathcot.									
Gossart. R. Syn. Colmar Gossart									Published in Magazine of Horticulture, 1855, p. 146.
Got. F280									Not described.
Got Luc de Cambron. GenF'33,196. D'45,437,'57,503,'69,773. HovI,5. AgR'62,185. Syn. of Glout Morceau.									
Goubault. Gb. Bul6. T'97,476. Syns. Beurre Goubalt, Beurre Goubault, Poire Goubault	For	obo	s	gy	jm	p	g	me	Originated in France in 1842.
Goubalt (Winter). T'97,480. Syn. of Goubault (Doyenne)									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Goubault (Doyenne). L. Syns. Chapen, Doyenne Goubalt, Doyenne Goubault, Goubalt (Winter).	Fr	obop	ml	yru	mj	sp	g-vg	vl	Originated at Angers, France.
Goulu Morceau. D'45,457,'57,503,'69,773. Hov1,5. E'54,325,'59,339. F280. Syn. of Glout Morceau.									
Goulue Morceau de Chambron. D'69,773. Syn. of Glout Morceau									
Gov. Carver. MassH'66,45	Mass.								Originated at Brookline, Mass. Fruited in 1863.
Governor Stuyvesant. GenF'37,278. Syn. of Bon Chretien (Sum.)									
Grace Wilder. MassH'74,152	Mass.?								Exhibited by Col. M. P. Wilder; probably named for a daughter.
Gracieuse. GenF'33,196. Syn. of Colmar									
Gracieuse. K'33,135. D'45,353,'57,454,'69,778. E'54,389,'59,417. H124. F276. Syn. of Hampden.									
Gracioli. Pr59. K'41,120. MassH'46,150. F278 Syn. of Bon Chretien (Sum.)									
Gracioli d'Hiver. D'69,686. Syn. of Diel									
Gracioli de la Toussaint. D'69,858. Syn. of Spanish									
Gracioli of Jersey. D'57,515,'69,791. F280. B'83,381. Syn. of Gratioli									
Gracioli (of the French). K'32,132. GenF'37,277. Syn. of Bon Chretien (Sum.)									
Gracioli Rouge. D'69,863. Syn. of Bon Chretien (Sum.)									
Graham's Autumn Nelis. D'69,664. Syn. of Autumn Nelis									
Graham's Bergamot. MagofH'59,69. CGenXIII,47. D'69,664. Syn. of Autumn Nelis.									
Grain de Corail. F280. Syn. of Forelle									
Graine de Coraile. MassH'51,189. Syn. of Forelle									
Grand Bretagne. MagofH'38,436. Hort'58,321. D'69,774. Syn. of Bretagne									
Grand Dauphin. MagofH'43,151. Syn. of Dauphin									
Grand duc de Toscane. MagofH'55,146. Syn. of Toscane									
Grande Bretagne dore. K'32,191. Cult'39,66. Syn. of Bretagne									
Grande Bretagne Doree d'Hiver. GenF'33,197. Syn. of Bretagne									
Grande Bretagne Doree Fondante. GenF'33,197. Syn. of Bretagne									
Grande Epine d'Ete. Pr28. Syn. of Great Summer Thorn									
Grand Isle. Dap176. A'87,95. H'87,166. IndH'86,82 MichBul31. IllH'92,173. AHM247.	Vt	robtp	m	y	jm	sv	vg	m	Originated by Benjamin Macomber, at Grand Isle, Vt.
Grand Mogul. D'69,716. Syn. of Catillac									
Grand Monarque. K'32,151,'41,128. D'45,432,'57,568,'69,716. E'54,392,'59,419. Syn. of Catillac.									
Grand Monarque. H162. Syn. of Yair									
Grand Salomon. F280. Syn. of Salomon									
Grand Soleil. K'41,170. MagofH'42,250,'53,107,197. E'54,369,'59,386. D'57,505,'69,775 H161. T'75,292,'85,310,'97,483. Syn. of Soleil.									
Grand Soliel. MassH'51,189. WHR11,560. AgR'54,245. CGenXXIII,288. H161. F280. Syn. of Soleil.									

Grand Tamerlan. D'69,716. Syn. of Catillac									
Grant. MassH'66,45. Syn. Gen. Grant	Mass.								Originated by Dr. S. A. Shurtleff. of Brookline, Mass. Fruited in 1862.
Grashlin. Hort'56,37. Syn. of Graslin									
Graslin. MagofH'51,472,'54,86,'59,526,'60,216. WHRIV,164. MassH'53,21. Hort'56,37,'72,38. D'57,505,'69,775. F280. E'59,386. A'56,90. FGAofO'72,14. T'75,264, '85,282,'97,461. Syn. Grashlin.	Fr	obop	m	gyru	jb	sv	g	m	
Gratiolet. AgR'55,296. Syn. of Gratioli									
Gratioli. L. Syns. Bedminster Gratioli, Gratiolet, Gracioli of Jersey, Gratioli de Jersey, Gratioli of Jersey, Jersey Gratioli, Norris Pear.	I. of Jer.	robop	m	gyru	jm	v	vg	me	Originated on the Isle of Jersey.
Gratioli. Pr59. D'45,346,'57,583,'69,863. Syn. of Bon Chretien (Sum.)									
Gratioli d'Automne. D'69,858. Syn. of Spanish									
Gratioli d'Ete. Pr59. D'45,346'57,583'69,863. F282. Syn. of Bon Chretien (Sum.)									
Gratioli de Jersey FGAofO'7561. BBL. Syn of Gratioli									
Gratioli di Roma. D'45,346,'57,583,'69,863. F282. Syn. of Bon Chretien (Sum.)									
Gratioli (of Jersey). B'31,316,'83,381. EFABC'00. Syn. of Gratioli									
Gratz. Hort'51,459									Exhibited at meeting of Pennsylvania Horticultural Society, August 19, 1851.
Graue Sommer Butterbirne. D'69,886. Syn. of Yat									
Grave de Corail. D'69,765. Syn. of Forelle									
Graves. E'59,404. D'69,833. Syn. of Pinneo									
Gray. AgR'64,142. Syn. of Gray Doyenne									
Gray Beurre. Pr49. K'32,135. D'45,357,'69,710. E'54,350,'59,360. F238. Syn. of Brown									
Gray Butter. GarCal587. Pr49. Syn. of Brown									
Gray Butter Pear. D'45,380,'57,437,'69,745. E'54,322'59,335. F279. T'85,293,'97,703. Syn. of Gray Doyenne.									
Gray Deans. GenF'33,196. D'45,380,'57,437,'69,745. MagofH'54,146. E'54,322,'59,335. F279. Syn. of Gray Doyenne.									
Gray Doyenne. Pr16. K'32,136,'41,122. Gen F'37,277. D'45,380,'57,437,'69,745. Cole167. E'54,322,'59,335. H162. F245,279. BHF'69,158. Bul6,8. AHM247. Syns. Beurre Doyenne Roux, Beurre Rouge (incorrectly of some), Butter Pear, Doyenne Boussouck (of some), Doyenne Cuvert, Doyenne d'Automne, Doyenne Galeux, Doyenne Galeuge, Doyenne Gray, Doyenne Grey, Doyenne Gris, Doyenne Rouge, Doyenne Roux, Gay Doyenne, Gray, Gray Butter Pear, Gray Deans, Gray Doyenne, Gray St. Michael, Grey Butter, Grey Doyenne, Late Virgalieu, Le Beurre, Red Buerre (incorrectly of some), Red Doyenne, St. Michael Dore.		ovobo	m	erru	gbm	v	b	m	Greatly resembles White Doyenne.
Gray Monsieur John. K'32,138. Syn. of Messire									
Gray St. Michaels. F245. Syn. of Gray Doyenne									
Gray Winter. L. Syns. Beurre de Fontenay, Beurre d'Hiver, Beurre de Lucon, Beurre Gris d'Hiver, Beurre Gris d'Hiver de Lucon, Beurre Gris d'Hiver Noveau, Beurre Gris de Lucon, Beurre Gris Superieur, Fontenay, Gray Winter Beurre, St. Michael d'Hiver.	Fr	robtp	m	ru	gjbm	sp	vg	vl	Introduced in America in 1836.
Great Bergamotte. D'69,778. Syn. of Hampden									
Great Blanket. Pr15. D'69,775. Syn. of Blanquette									
Great Blanquette. Pr15. D'69,775. Syn. of Blanquette									
Great Bretagne. MagofH'38,436. Hort'63,217. D'69,774. FGAofO'74,68. A'75,97. BBCo. BBL. Syn. of Bretagne.									
Great Cassolette. Pr62. Syn. Grosse Cassolette		t		g	m	a		me	Briefly referred to by Prince, p. 32.
Great Citron (of Bohemia). MagofH'42,59. MassH'45,89. D'45,392,'57,574,'69,775. A'54,258. E'54,392,'59,419. T'75,547,'85,563,'97,703. Syn. of Bohemia.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Great King Louis. Cult'47,340. Syn, of King Louis									
Great Mammoth. HHH'69,240									Grown in pioneer days in Edgar County, Ill.
Great Mouthwater. D'69,863. Syn. of Franc Real (Sum.)									
Great Mouthwater. Pr36. Syn. of Long Green									
Great Musk Pear of Conc. Pr11. D'69,818. Syn. of Muscat Robert									
Great Onion Pear. Pr24. K'32,132. D'69,862. Syn. of Archduke									
Great Orange. Pr42. D'69,825. Syn. of Orange Striped									
Great Pear. A'79,80. HMHS14. Syn. of Endicott									
Great Pear of Vitrier. Pr107. Syn. of Grosse Vitrier									
Great Rake Pear. Pr117. Syn. of French Pound									
Great Rousselet. Pr21. D'69,843. Syn. of Summer King									
Great Summer Thorn. Pr28. Syn. Grande Epine d'Ete									
Greeley. L. Syn. Horace Greeley	Conn	robtp	ml	yg yru	m cojm	s s		me m	Originated by Dr. J. J. Howe, of Birmingham, Conn.
Green Achan. MagofH'43,130. Syn. of Achan									
Green Bergamot. Gb. Syn. Bergamot Zelenni	Rus.?								Brought to America in 1882.
Green Beurre. Hort'60,449									Exhibited at Louisville, Ky., in the autumn of 1860.
Green Butter. Pr49. Syn. of Brown									
Green Catharine. SW. A'54,238. E'54,394,'59,421. H162. Syn. of Early Rousselet									
Green Catharine. C184. MagofH'50,296. Syn. of Rheims									
Green Catharine. K'32,137,'41,120. Syn. of Summer Thorn									
Green Chisel. SW. Pr14. GenF'37,277. Cult'39,66. D'45,337,'69,775. A'54,238. E'54,396,'59,422. H162. T'75,547,'85,563,'97,703. Syn. of Chisel.									
Green Chisel. K'32,137,'41,126. D'57,582. F282. Syn. of Franc Real (Sum.)									
Green Chisel. Pr17. Syn. of Hastiveau									
Green Chisel (incorrectly). C178. Pr13. K'32,129. D'45,341,'57,441. F281. T'85,270. Syn. of Madeleine.									
Green Chissel. GarCal587. Syn. of Chisel									
Green Citron of Bohemia. F280. Syn. of Bohemia									
Green Cluster. A'73,75. AgR'75,380. Syn. of Nabours									
Green Germantown. Hort'49,567,'56,155. E'54,358,'59,371. Hof. Syn. of Chancellor.									
Green Magdalen. EFABC'00									In the experimental orchard at Agassiz, B. C.
Green Mountain Boy. E'54,369,'59,386. H162. F273. D'69,775. T'75,547,'85,563,'97,704. Syn. of Mountain.									
Green Mouth Water. K'32,138. Syn. of Long Green									
Green Muscat. K'32,127. Syn. of Cassolette									
Green Muscat or Eche frion. Pr31. Syn. of Cassolette									
Green Pear. SW. [An August variety in the Catalogue of Silas Wharton, 1824]									
Green Pear of Laxton. MagofH'43,131. Syn. of Laxton									

Green Pear of Yair. K'32,136,'41,127. M'38,71,'44,55. Cult'39,66. D'45,392,'57,574,'69,776. E'54,396,'59,422. H162. F280. Syn. of Yair.									
Green Rennet. GarCal587									Published by M'Mahon in Gardener's Calendar in 1806.
Green Satin. Pr115. Syn. of Lansac									
Green Sugar. D'57,582. F282. Syn. of Franc Real (Sum.)									
Green Sugar. Pr57. K'32,137,'41'127. GenF'33,197. Cult'39,66. MagofH'50,296. A'54,228. E'54,396,'59,422. D'57,582,'69,861. H192. T'75,548,'85,563,'97,704. Syn. of Green Sweet.									
Green Sugar (of some English Gardens). D'45,337. Syn. of Chisel									
Green Summer. Th187. Syn. of Green Sweet									
Green Summer Sugar. K'32,155. IndF'40,182. Syn. of Hoyerswerda									
Green Summer Sugar Pear (of Hogerswerda). DomEncIV,186. MagofH'37,49. Syn. of Hoyerswerda.									
Green Sweet. L. Syns Bayonnaise, Green Sugar, Green Summer, Gris de Chine, Prince's Green Sugar, Sucre Verd, Sucre Vert, Sugar Pear, Sukerey d'Automne, Verdette.		obop	ms	g	jm	s	g	m	
Green Sylvange. GenF'37,277. D'45,413,'57,583,'69,866. E'54,400,'59,425. F283. T'75,584,'85,563,'97,704. Syn. of Sylvange.									
Green Table. EFABC'00									In the experimental orchard at Agassiz, B. C.
Green Vine. OH'86,75	Rus.?								Introduced from Russia by Leo Weltz, of Ohio.
Green Windsor. D'69,883. Syn. of Windsor									
Green Wine. Gb. Syns. Grune Weinbirne, Weinbirne Grune.	Rus.								Introduced from Russia in 1882. May be same as Green Vine.
Green Winter Sylvanche. Pr214. Syn. of Sylvange									
Green Yair. Cult'39,66. D'45,392,'57,574,'69,776. MagofH'50,296. A'54,238. E'54,396,'49,422. T'75,548,'85,563, '97,704. Syn. of Yair.									
Greer. R. Syn. Ira Greer									In Benjamin Buckman's list as Ira Greer.
Gregoire. R. EFABC'00. Syn. Prince Imperial de France	Belg.	obop	l	gyrub	mj	sp	....	m	Raised by M. Gregoire.
Gregoire Bordillon. B'83,381. EFABC'00. Syn. of Bordillon									
Grella. Gb	Rus.?								Imported in 1879 by Charles Gibb Not described.
Grenade. D'69,851. Syn. of Sanguinole									
[illegible]. D'69,762. Syn. of Lucrative									
Grey Beurre. D'57,471. Syn. of Brown									
Grey Butter. DomEncIV,184. Th187. EHF'68,311. T'75,548,'85,563. Syn. of Gray Doyenne.									
Grey Doyenne. AgR'50,358. T'75,275,'85,293. Syn. of Gray Doyenne									
[illegible]. FGAoIO'91,14. Syn. of Dame									
Grieve. L. Syn. Lucy Grieve	Eng.	obtp	m	yru	dgjm	s	...	m	Raised by Lucy Grieve, of Guilford, England.
Griffith. L. Syns. John Griffith, Griffith's Summer	N. Y.	robtp	m	gybru	com	s	g	me	Originated in Westchester County, N. Y.
Griffith's Summer. GarCal587. Syn. of Griffith									
Grignon. R. Syn. Lebon Grignon									In Andorra Nurseries Catalogue for 1895.
Gris. T'97,704. Syn. of Brown									
Gris de Chine. F280. D'69,861. Syn. of Green Sweet									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Greise-Bonne. C185. Pr34. K'32,137,'41,119. A'51,238. E'54,396,'59,422. H162. Syns. Ambrette d'Ete. Crapaudine, Good Grey, Grisse Bonne, Rude Epee, Toad pear Gray Good or Summer Ambrette.		t	s	g	coj			me	Very old and probably obsolete.
Grisse Bonne. MagofH'50,296. Syn. of Grise-Bonne									
Gromier. R. Syn. Dr. Gromier		rp	ms	gbru	j	sp		m	In the experimental orchard at Agassiz, B. C.
Groom. L. Syns. Bergamotte Matthews' Eliza, Groom Princess, Groom's Princess Royal. Mathews' Eliza, Matthews' Eliza, Princess Royal.	Eng.	r	m	gbru	bmg	s	vg	vl	Raised by Mr. Groom, the famous tulip grower.
Groom Princess. F280. Syn. of Groom									
Groom's Princess Royal. MagofH'41,286,'51,65,'52,438, D'45,438,'57,505,'69,776. E'54,381,'59,386,406. H162. T'75,548,'85,563,'97,704. Syn. of Groom.									
Groote Mogul. K'32,151. D45,432,'57,568,'69,716. E'54,392,'59,419. Syn. of Catillac.									
Gros Angobert. D'69,661. Syn. of Angobert									
Gros Blanquet. Pr15. K'41,118. A'54,238. Syn of Blanquette									
Gros Blanquet Rond. Pr15. K'41,126 D'69,797. Syn. of Round Blanquet									
Gros Bon Chretien. Pr59. D'69,863. Syn. of Bon Chretien (Sum.)									
Gros Bon Chretien Beauclerc. D'69,863. Syn. of Bon Chretien (Sum.)									
Gros Bon Chretien d'Ete. D'69,863. Syn. of Bon Chretien (Sum.)									
Gros Certeau d'Ete. D'69,717. Syn. of Summer Certeau									
Gros Colmar Van Mons. D'69,725. Syn. of Invalides									
Gros Cotelain. F280. Syn. of Cotelain									
Gros Dillen. K'32,175,'41,156. D'45,360,'57,424,'69,686. HovI,77. F277. T'75, 548,'85,563,'97,704. Syn. of Diel.									
Gros Dillon. HovI,77. F210. Syn. of Diel									
Gros Dillen. Pr200. Syn. of Dillen									
Groseilliere. F194,276. Syn. of Lucrative									
Gros fin or long d'Hiver. D'69,855. Syn. of Pound									
Gros Franc Real. K'41,124. D'69,772. Syn. of Gilogil									
Gros Franc Real d'Hiver. D'69,660. Syn. of Angelique									
Gros Franc-real or Franc-real Gros. Pr79. Syn. of Angelique									
Gros Gilot. F279. Syn. of Catillac									
Gros Gilot. D'69,772. Syn. of Gilogil									
Gros Gobet. Pr111. D'69,772. Syn. of Gilogil									
Gros Guy Grilland. D'69,772. Syn. of Gilogil									
Gros Hastiveau. L. Syns. Gros Hastiveau de la Foret, Gros Hativeau de la foret, Hativau de la foret, Hativeau Gros de la foret, Large Hativeau of the forest.		t		wr	cr	v	p	me	
Gros Hastiveau de la foret. Pr18. Syn. of Gros Hastiveau									
Gros Hativeau. K'41,118									Mr. Lyon thought this might be Lativeau of Field.
Gros Hativeau de la foret. Pr18. Syn. of Gros Hastiveau									
Gros Lativeau. F280. Syn. of Lativeau									
Gros Loijart. MagofH'43,126. Syn. of Loijart									
Gros Lucas. F280. Syn. of Lucas									

Gros Micet. D'69,766. Syn. of Franc Real (Win.)								
Gros Micet d'Ete. Pr134. K'32,185,'41,113. GenF'33,197. MagofH'43,367. D'45, 344,'57,582,'69,863. E'54,384,'59,411. F282. Syn. of Franc Real (Sum.)								
Gros Mouille Bouche. D'69,863. Syn. of Franc Real (Sum.)								
Gros Mouille Bouche. Pr56. K'32,138. Syn. of Long Green								
Gros Muscadille. D'69,668. Syn. of Brussels								
Gros Oignonet. Pr24. D'69,892. Syn. of Archduke								
Gros Quere. D'69,734. Syn. of Louvain								
Gros Rateau. K'32,151,'41,128. D'69,716. Syn. of Catillac								
Gros Rateau. Pr110. Syn. of Rateau								
Gros Rateau Gris. K'41,128. D'69,716. Syn. of Catillac								
Gros Rateau Gris. Pr117. Cult'47,340. Syn. of French Pound								
Gros Romain. E'54,390,'59,418. Syn. of Romain								
Gros Rousselet. Pr21. K'32,28,'41,119. A'54,238. E'54,399,'59,424. D'69,843. Syn. of Summer King.								
Gros Rousselet d'Aout. D'57,505,'69,776. F280. E'59,386. T'75,548,'85,563,'97,704. Syn. of August Rousselet.								
Gros Saint Jean Musquee. Pr11. Syn. of Muscat Robert								
Grosse Alongee. Pr80. Syn. of Large Oblong								
Grosse Allongee. D'69,875. Syn. of Vicar								
Grosse Ambrette. F276. Syn. of Bergamote d'Automne								
Grosse Angleterre. Cult'47,340. Syn. of Angleterre (Nois.)								
Grosse Angleterre de Noisette. Pr15. K'32,175,'41,168. Syn. of Angleterre (Nois.)								
Grosse Bessemianka. [Pear without seeds.] CanH'94,291	Rus.?	l	g	b	g			May differ from Bessemianka.
Grosse Blanquet. Pr15. K'32,128. D'69,775. Syn. of Blanquette								
Grosse Blanquette. Pr15. D'69,775. Syn. of Blanquette								
Grosse Blanquette Ronde. Pr15. K'41,126. D'69,797. Syn. of Round Blanquet								
Grosse Calebash. MagofH'47,188. Syn. of Van Marum								
Grosse Calebasse du Nord. D'69,873. Syn. of Van Marum								
Grosse Calebasse of Langlier. MassH'53,20. MagofH'54,85. AgR'54,245. E'59,363. T'75,548,'85,563,'97,704. Syn. of Van Marum.								
Grosse Calebasse of Noisette. MagofH'54,85. Syn. of Van Marum								
Grosse Cassolette. Pr32. Syn. of Great Cassolette								
Grosse Cramoisie. Pr19. Syn. of Crimson								
Grosse Cuisse Madame. Pr152. GenF'33,197,'37,277. D'45,337,'57,514,'69,758. E'54, 373,'59,393. F280. Syn. of Jargonelle (Eng.)								
Grosse Dame Jeanne. D'69,835. Syn. of Pound								
Grosse de Bruxelles. F283. D'69,835. Syn. of Pound								
Grosse Dorothee. D'45,360,'57,424,'69,686. HovI,77. E'54,313,'59,327. F277. AgR-'62,181. Syn. of Diel.								
Grosse Figue. D'69,700. Syn. of Figue								
Grosse Grand Bretagne. D'69,858. Syn. of Spanish								
Grosse Grand Bretagne Doree. D'69,858. Syn. of Spanish								
Grosse Jargonelle. D'69,883. Syn. of Windsor								
Grosse Marie. D'57,505,'69,811. F280. E'59,386. T'75,548,'85,563,'97,704. Syn. of Marechal								
Grosse Mouille Bouche. MassH'44,63								Exhibited by William Kenrick at meeting of Massachusetts Horticultural Society, 1844.
Grosse Muscadelle. Pr23. Syn. of Large Muscadel								
Grosse Poire de Vitrier. Pr107. Syn. of Grosse Vitrier								
Grosse Quisse Madame. K'32,128. Syn. of Jargonelle (Eng.)								

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color	Texture.	Flavor.	Quality.	Season.	Remarks.
Grosser Katzenkopf. MHSC'85,26	Ger	r	vl	yru				ml	An old German variety; hardy and fruitful.
Grosse Rois Louis. D'69,775. Syn. of Blanquette									
Grosse Rommelter. MHSC'85,28		r	m	g				m	Esteemed for making perry.
Grosse Sucre. D'69,697. Syn. of Scheidweiler									
Grosse Van Marum. MagofH'54,85. Syn. of Van Marum									
Grosse Vitrier. L. Syns. Great Pear of Vitrier, Grosse Poire de Vitrier		t	l	yr		p		ml	
Gros Thomas. D'69,716. Syn. of Catillac									
Gros Zucherbirne. CanExFR'96,136									In experimental orchard at Agassiz, B. C.; not described.
Groveland. NHI'87,32. C(O)HS87,69. MichSB27. AHM248.									A Bartlett seedling from Pekin, Ill.
Grumkower. Pr207. D'69,776. A'83,74. Gb. IndH'85,27. IaH'85,382. EFA-BC'00. Syn. Grumkower Winterbirne.	Eur		m		mj	sp		ml	An old European variety described by Lindley.
Grumkower Winterbirne. Pr207. K'32,175,'41,168. D'69,776. MHSC'82,59. FGA of O'83,223. Syn. of Grumkower.									
Grune Magdalena. D'69,809. Syn. of Madeleine									
Grune Sommer. AofH'92,277. Syn. of Madeleine									
Grune Sommer Magdalena. D'69,809. Syn. of Madeleine									
Grune Weinbirne. Gb. Syn. of Green Wine									
Grusha Baba. Gb. Syn. of Baba									
Guenette. D'69,775. Syn. of Chisel									
Guernsey. L. Syns. Buerre Millet of Guernsey, Beurre Mollett's Guernsey, Mollet's Guernsey Chaumontel.	For								Published by Field, p. 277; not described.
Guernsey. Pr145. D'45,412,'57,545,'69,859. MagofH'49,346. E'54,338,'59,351. AgR'63,126. T'75,548,'85,563,'97,704. Syn. of Stevens.									
Guerre. R. Syn. Guerre (Poire de)									Published in Magazine of Horticulture, 1843, p. 131.
Guillard. R. Syn. Doyenne Guillard									In the experimental orchard at Agassiz, B. C.
Guillaume de Nassau. D'69,686. Syn. of Diel									
Guisse. L. Syn. Marie Guisse	For	oblp	m	yc	gm	so		vl	Originated near Metz in 1834.
Gurle's Beurre. GenF'33,196. D'45,366,'57,457,'69,769. HovII,77. E'54,369,457,'59,384. F277. Syn. of Gansel Bergamot.									
Gust. L. Syn. Jolie Fille de Gust	Belg	rp	s	ycr	co			me	
Gustave. R. Syn. Bon Gustave		p	ml	gy					Published by Magazine of Horticulture, 1845, p. 111.
Gustave Bivort. D'69,776	Fr	r	m	yrru	jm	sp	g-vg	me	
Gustave Burgoyne. MagofH'52,419. D'69,776. Host'70,355. Syn. of Burgoyne									
Gustave de Bourgogne. F280. Syn. of Bourgogne									
Gustin. L. Syns. Gustine's Summer, Gustin's Summer	N.J.	r	s	y		s	p	me	A New Jersey variety of doubtful value.
Gustine's Summer. MagofH'49,106,348. Syn. of Gustin									

	Gustin's Summer. D'57,575,'69,776. F273. T'75,548,'85,563,'97,704. Syn. of Gustin.									
	Gute Graue. D'69 886. Syn. of Yat.									
	Gute Graue. Gb. CanExFR'96,136	Rus.?								In the experimental orchard at Agassiz, B. C.
126	**Guyot.** R. Syn. Jules Guyot				y	mj	sp	vg	e	Resembles Bartlett, but is earlier.
	Hacon. L. Syns. Celestins, Downham Seedling, Hacon's Incomparable, Incomparable Hacon's, Rayner's Seedling.	Eng.	rt	lm	ygbru	bm	v	g	m	Raised by Mr. Hacon, of Downham Market.
	Hacon's Incomparable. Pr 2[illegible]. K'32,175,'41,146. GenF'33,197,'37,277. Cult'39,66. MassH'[illegible]. D'45,[illegible],'69,777. Cole167. MagofH'40,49,'42,249. B'51,306. E'54,370,'59,386. H163. F290. T'75,548,'85,563,'97,704. Syn. of Hacon.									
	Hacon Seedling No. 3. MassH'74,158. WNYH'80,116. Syn. of Hoosic.									
	Haddington MagofH'47,274. Hort'47,4[illegible]. MassH'47,90. E'54,371,'59,387. D'57,[illegible],'69,777. H163. F273. T'75,548,'85,563,'97,704. Syn. Smith's Haddington.	Pa.	obop	ml	gyb	crj	p	g	vl	Raised by J. B. Smith, of Philadelphia, Pa.
	Hadley. [illegible] D'69,755. HMHS222. Syn. of Kirtland.									
	Hadley Pear (supposed). K'32,167. Syn. of Capsheaf.									
	Haffner. L. Syns. Beurre Haffner, Beurre Haffner (Liegil)	Belg.	obop	m	gyru	gjm	s	vg	m	Resembles Flemish, but is distinct.
	Hagar. D'69,777.	Fr.	obtp	m	yrru	co	s	p	m	
	Hagerman. WHRIV,449. E'54,330,'59,386. H163. T'75,275,'85,293,'97,471. Syn. of Hegeman.									
	[illegible] MassH'47,60. T'85,272,'97,704. Syn. of Limon.									
	[illegible] d'Hiver. D'69,[illegible]. Syn. of Beauchamps.									
	Haight. D'69,777.	Amer.	rp	m	yrru	cob	s	g	m	
	Hamberg. AgofH'91,260. CanH'91,12. FGAofO'92,103. Syn. of Hamburg.									
	Hamburg. CanH'91,12. FGAofO'92,103. Syn. Hamberg	Rus.		ml	yg	j	p		m	Its chief merit is the hardihood of tree.
	Hamecher. L. T'97,704. Syns. Beurre Hamecher, Beurre Hamecker, Beurre Hammecher.	Belg.	rp	m	y		s	p	m	
	Hamilton. D'69,777. Syn. Hamilton Seedling.	S. C.	ob	m	yru	co	a	p	m	Said to be good in South Carolina; poor at the North.
	Hamilton Seedling. D'69,777. Syn. of Hamilton.									
	Hamon. F290. Hort'50,45. D'69,777. Syns. Besi Fondante, Besi Hamon, Beurre Seringe.	Fr.	ov	ms	gy	mj	s	g	me	Originated by M. Nerard, of Lyon, France.
	Hampden. D'69,778. Syns. Belle de Bruxelles, Belle de Luxembourg, Belle et Bonne, Belle Sans Pepins, Bergamot d'Ete, Bergamot Hampden's, Bergamotte d'Angleterre, Bergamotte de Bruxelles, Bergamotte d'Ete, Bergamotte d'Ete Grosse, Bergamotte de Paysons, Beuzard, Deutsche National Bergamotte, [illegible], [illegible], [illegible], Gracieuse, Great Bergamotte, Hampden's Bergamot, Longueville, Longueville d'Ecosse, Marquis d'Hern, Milan Vert, Poire Sans Pepins, Sans Pepins, Schone and Gute, Scotch Bergamot, Seedless, Summer Bergamot.		rob	l	gyru	codj	s	g	me	Formerly very popular; now little grown.
	Hampden's Bergamot. K'41 168. MassH'44,60. D'45,330,'57,565,'69,778. [illegible] H163. T'85,570. Syn. of Hampden.									
	[illegible] LaH'84,500. Syn. of Hampton Bergamot									
	[illegible] Pres. GenF'37,277. KanH'82,136. Syn. of Summer Bergamot.									
	[illegible] A[illegible]. WHRIV,449. MagofH'55,91. E'59,3[illegible]. D'69,780. Syn. of Hegeman.									
	[illegible] L. [illegible]. Syn. of Hampton Cluster.									
	Hampton Bergamot. L. Syns. Hampden's Bergamot, Hampton's Bergamot.	Ohio	rob		yru	cojm	v	g		Originated by W. C. Hampton, of Mount Victory, Ohio.
	Hampton's Bergamot. D'69,778. Syn. of Hampton Bergamot.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Hampton Cluster. L. Syns. Cluster Pear, Hampton, Hampton's Cluster	Ohio	r	vs	gyrru	jm	s	vg	me	Originated by W. C. Hampton, of Mount Victory, Ohio.
Hampton's Cluster. D'69,778. Syn. of Hampton Cluster									
Hampton Virgalieu. E'59,388. Syn. Hampton's Virgalieu.	Ohio	rp	m	gyru	gjm	v	vg	m	Originated by W. C. Hampton, of Mount Victory, Ohio.
Hampton's Virgalieu. D'69,778. Syn. of Hampton Virgalieu									
Hamus. E'54,370,'59,388. Syn. of Hanners									
Hancock. MassH'66,44	Mass.								Originated by Dr. Shurtleff, of Brookline, Mass. Fruited in 1861.
Hanging Pear. Pr84. Syn. of Pendant									
Hanna. D'57,485. Syn. of Hanners									
Hannas. MassH'44,60. Hort'48,397. B'51,306. D'69,778. Syn. of Hanners									
Hanners. MagofH'47,489,'50,72. B'51,306. E'54,370,'59,388. D'57,485. H163 F273. A'62,68. T'75,275,'85,293,'97,471. Syns. Hamus, Hanna, Hannas, Hanners'.	Mass	obtp	l	gyru	jm	sp	vg	me	C. M. Hovey, in Magazine of Horticulture, 1850, p. 72, said, "This is Cushing."
Hanners. Cole159. MagofH'50,72. Syn. of Cushing									
Hanners'. E'54,370. D'57,778. T'85,293. Syn. of Hanners									
Hanover. MagofH'53,516,'54,268. E'54,370,59,388. D'57,506,'69,779. H163. F273. T'75,548,'85,563,'97,704.	N. J	robo	ms	yrub	mj	v	g	m	Originated at Hanover Furnace, N. J.
Hardempont. Pr91. Syn. of Glout Morceau									
Hardenpont. Pr91. D'69,773. T'97,704. Syn. of Glout Morcea									
Hardenpont (Ang.) L. Syns. Beurre des Hautes, Beurre Lasalle, Delices d'Angers, Delices d'Ardenpont, Delices d'Hardenpont, Delices d'Hardenpont d'Angers, Delices d'Hardenpont de Toulouse, Delices d'Hardenpont of Angers, Vignes.	Fr	r	m	gyru	mj	sp	g-vg	m	
Hardenpont (Belg.). L. Syns. Arch Duc Charles, Archduke Charles, Beurre Curtet (of A. Leroy), Charles d'Autriche, Charles of Austria, Delices d'Ardenpont, Delices d'Hardenpont, Delices d'Hardenpont du Nord and Belgium, Delices d'Hardenpont of Belgium, Fondante Pariselle, Fondante Pariselle du Comice, Horticule, Pariselle.	Belg	tr	m	gy	bjm	sp	g	ml	
Hardenpont d'Hiver. GenF'33,197. K'41,161. D'45,437,'57,503,'69,773. HovI,5. E'54,325,'59,339. F280. T'85,306. Syn. of Glout Morceau.									
Hardenpont du Printemps. Pr51. K'32,190,'41,158. GenF'33,198,'37,278. D'45,427,'57,473,'69,696. E'54,351,'59,361. F277. Syn. of Rance.									
Hardenpont du Printemps (of some). D'45,438. Syn. of Jaminette									
Hardenpont's Winter Butterbirne. D'45,437. HovI,5. Syn. of Glout Morceau									
Hardy. S92. MichH'88,118. IllH'95,167. T'97,471. Bul6,8. FESofO'01,20. AHM248. Syns. Beurre Hardi, Beurre Hardy, Beurre Sterckmans, Beurre Sterkman, Sterkman's Beurre (erroneously).		obtp	l	grub	bmj	vp	vg	m	
Harlow. MeP'76,11,'77,12	Me								Orginated by S. C. Harlow, of Bangor, Me., from seed of Bartlett,

Harnard. NJH'77,11	N. J								Exhibited at meeting of New Jersey Horticultural Society, 1877, by Mr. Hanard.
Harriet. MagofH'49,43	Conn								Originated at New Haven, Conn., by Governor Edwards.
Harris. D'69,779. Syn. Speckled Harris	Ga	ap	m	yr	b	s	g	m	
Harris. MassH'74,153,'82,25,'95,233. Hort'75,1. A'75,119,'79,96,'81,98. Dap1,49. HMHS383. Syn. Clapp No. 3.	Mass	oblp	m	yeru	dbjm	spv		me	In Massachusetts Horticultural Society's Report, 1860, p. 50, No. 3 appears as Clapp Favorite.
Harrison. L. Syns. Autumn Bon Chretien, Belleville Baking, Englebert Lott, Harrison Autumn, Harrison's Fall, Harrison's Fall Baking, Harrison's Large Baking, Harrison's Large Fall, Large Swan's Egg, Lott's Pear, Mogul Summer, Richmond, Rushmore's Bon Chretien.	Amer	obtp	l	yr	co			me	A justly celebrated baking pear.
Harrison Autumn. MassH'48,100. Syn. of Harrison									
Harrison's Fall. E'54,396,'59,422. Syn. of Harrison									
Harrison's Fall Baking. IndF'40,105. MassH'44,60,'46,154. Syn. of Harrison.									
Harrison's Large Baking. SW. Syn. of Harrison									
Harrison's Large Fall. C204. Cole174. D'57,575,'69,779. H164. T'75,548,'85,563,'97,704. Syn. of Harrison.									
Harvard. Pr145. K'32,176,'41,146. M'38,78,'44,76,'47,81. IndF'40,182. D'45,392,'57,506,'69,779. Hort'47,47. Cult'47,340. Cole159. B'51,306. Wg71. E'54,370,'59,389. H164. F273. MagofH'54,469. T'75,264,'85,282,'97,461. Syns. Belle de Flushing, Boston Eparne, Boston Epargne, Boston Epergne, Boston L'Epergne, Cambridge Sugar Pear, L'Epergne, Sugar Pear.	Mass	oblp	ml	yrubr	djm	v	vg	me	Originated at Cambridge, Mass., near Harvard College.
Harvest. WHRIV,160. E'54,366. D'69,779. Wn1,325,II,335,III,257. Syns. Amire Joannet, Archiduc d'Ete, Early Sugar, Harvest Pear, Joannet, Joannette, Petit St. Jean, St. Jean, St. John's Pear, Sugar Pear, Summer, Wolcott's Early.	Amer	r	ms	yrb	jm	s	g	e	An early variety; probably distinct from Early Harvest.
Harvest. MagofH'37,49. E'54,399,'59,424. Syn. of Sugar Top									
Harvest Belle. IllH'93,76									Shown at World's Columbian Exposition by Illinois Horticultural Society.
Harvest Pear. E'59,381. Syn. of Harvest									
Harvest Pear. D'45,330,'57,450. Syn. of Joannet									
Harvest (Prince). L. Syn. Prince's Harvest	N. Y	ovp	s	ybru	brj	sp	g	ve	Raised by William Prince, of Flushing, Long Island, N. Y.
Hasel. MagofH'39,391									Not described.
Haspin. L. Syn. Maleonnaitre d'Haspin		robo	l	ybmru	jdm	sp		m	Mentioned by Col. M. P. Wilder in his report.
Hasselbern. D'69,783. Syn. of Hessel									
Hasthewaite. MagofH'43,131									Not described.
Hastie's Early. OH'85,177. Syn. of Craig									
Hasting pear. Pr13. Syn. of Madeleine									
Hastiveau. Pr17. MagofH'50,296. A'54,278. Syns. Green Chisel, Hativau, Hativeau, Hativeaux.		t		yr	m	sa	g	e	Mr. Prince considered this the same as Chisel.
Hativeau. C178. Pr14. H164. Syn. of Chisel									
Hatch's Early (of the Cin. Hort. Socy.). OH'85,177. Syn. of Craig									
Hatfield. R. Syn. Hatfield's Pear									Catalogued by Silas Wharton in 1824.
Hatfield's Pear. SW. IndH'72,110. Syn. of Hatfield									
Hathorne's Seedling. MassH'48,98. MagofH'50,296. Syn of Hawthorne.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Hativau. Pr17. Syn. of Hastiveau									
Hativau de la foret. Pr18 MagofH'43,131 Syn. of Gros Hastiveau									
Hativeau. C178. K'41,118. H164. D'69,775. Syn. of Chisel									
Hativeau. Pr17. Syn. of Hastiveau									
Hativeau Blanc. D'69,863. Syn. of Franc Real (Sum.)									
Hativeau Gros de la foret. Pr18. Syn. of Gros Hastiveau									
Hativeaue. Pr17. Syn. of Hastiveau									
Haute Montee. F280. Syn. of Montee									
Hawaii. IndH'79,49. MichH'80,84. Bl229,244. LaB22. OH'98,8. PJB'01. Syn. Sandwich Island Pear.									Dr. Black thinks this belongs to the Oriental class of pears.
Hawes. L. Syns. Hawes' Winter, Hewes' Winter, Morgan	Va.	r	ms	gyru	bmj	s	g	m	Originated in King and Queen County, Va.
Hawes' Winter. D'57,506,'69,780. AgR'58,421. E'59,389. T'75,548,'85,563,'97,704. Syn. of Hawes.									
Hawthorne. R. Syns. Hathorne's Seedling, Hawthorne's Seedling									Exhibited by Robert Manning, at meeting of Massachusetts Horticultural Society, 1844, p. 60.
Hawthorne's Seedling. MagofH'43,388. MassH'44,60. A'54,238. Syn. of Hawthorne.									
Hayer. MichH'76,143									Not described.
Hays. MassH'44,61. MagofH'50,296. A'54,238. KanH'74,158	Pa.							me	Originated in Cumberland County, Pa., about 1800.
Hazel. Pr202. K'32,176,'41,147. GenF'33,197. D'45,337,'57,575,'69,783. E'54,396,'59,122. H164. F280. KanH'82,136. IaH'84,508. T'75,548,'85,563,'97,704. Syn. of Hessel.									
Heathcot. MagofH'37,15,'46,438. M'38,78,'44,60,'47,65. D'45,394,'57,507,'69,780. Hort'46,241,'47,417. MassH'48,102. Cole162. G84. B'51,306. Wg71. HovI,89. E'54,326,'59,389. H165. F273. HMHS222. T'75,275,'85,293,'97,471. Syns. Gore's Heathcot, Heathcot de Gore.	Mass.	obo	m	gyru	bmj	v	g-vg	m	First shown at meeting of Massachusetts Horticultural Society, November, 1829.
Heathcot de Gore. F280. Syn. of Heathcot									
Hebe. Hort'66,198. A'67,190,'77,137. AJofH,III,319,VII,233. D'69,780. GaH'85,47,'93,54. Ill H'96,204.	S. C.	robo	l	gyru	mb	v		l	Raised by William Sumner, of Pomaria, S. C.
Hebron. Cult'45,304. MagofH'58,503. Hort'58,166,473,482,'59,170,'75,211. A'58,54,'62,70. E'59,404. AJofHVIII,158. Syn. of Pinneo.									
Heere pear. Pr71. Syn. of Bergamot (Aut.)									
Hegeman. F273. D'69,780. T'75,275,'85,293,'97,421. Syns. Hagerman, Hampton, Hegerman, Heggerman.	N. Y.	rov	m	gyru	jm	s	g-vg	m	Originated by Andrew Hegeman, at North Hempstead, N. Y.
Hegerman. NAPC'49,17. MagofH'50,153,'55,91. D'57,506,'69,780. Syn. of Hegeman.									
Heggerman. D'69,780. Syn. of Hegeman									
Heidelberg. MagofH'53,566. A'54,84. D'57,567,'69,703. E'59,367. Syn. of Bleecker.									
Helmbourg. L. Syns. Bergamote de Heimbourg, Bergamotte Hambourg, Bergamotte Heimbourg.	Belg.	obl	l	gybr	djb	sp		m	Raised by M. Bivort.

Helen. R. Syn. Helen No. 4 (Peffer)									In the experimental orchard at Agassiz, B. C.
Helen No. 4 (Peffer). CanExFR'96,136. Syn. of Helen.									
Helene. L. Syns. Duchesse Helene d'Orleans, Helene d'Orleans, Princess Helen d'Orleans, Reine de Vierge.		obl	l	yru	jm	sv	g-vg	m	First distributed in 1847.
Helene d'Orleans. T'97,409. Syn. of Helene									
Helene Gregoire. MagofH'57,155,'60,220. D'69,780. T'75,548,'85,563,'97,704	Belg	ov	l	gyrru	jm	sp		m	Raised by M. Gregoire, of Jodoigne, Belgium.
Heliote Dundas. F280. Syn. of Dundas									
Hellman. R. Syn. Hellman's Melon									Being tested at Agassiz, B. C.
Hellman's Melon. EFABC'00. Syn. of Hellman									
Hemenway. McP'78,14. Syn. of Hemminway									
Hemminway. R. Syns. Hemenway, Madame Hemminway	Amer			gyru	mj	s	g	me	Ellwanger & Barry introduced it.
Henkel. MagofH'47,61,137,'60,508. Cult'47,340. Hort'49,456. B'51,306. HovH [illegible]. E'54,371,'59,390. D'57,507,'69,781. H164. F280. T'75,276,'85,294,'97,471. A'62,68. GaH'86,26. Syns. Cumberland, Cumberland of Belgium, Henkel d'Automne.	Belg	obtp	lm	gyru	jm	v	vg-b	me	Originated in 1835 by Dr. John Van Mons.
Henkel d'Automne. Dap155. Syn. of Henkel									
Henkel d'Hoer. D'69,871. Syn. of Urbaniste									
Hennan. L. Syn. Professeur Hennan	Fl.	ovp	ml	ybr	mj	s		l	From Annals of Pomology.
Henri Bivort. MagofH'54,462. D'57,508,'69,781. F280. E'59,390. T'75,548,'85,563 '97,704. Syns. Henri (Bivort), Henry de Bivort.	Belg	obop	m	gyru	jm	s	g	me	
Henri (Bivort). D'69,781. Syn. of Henri Bivort									
Henri Caperon. F280. Syn. of Caperon									
Henri Courcelles. EFABC'00. Syn. of Courcelles									
Henri de Bourbon. EFABC'00. CanExFR'05,420. Syn. of Bourbon									
Henri Decaisne. FGAofO'83,72									Not described.
Henri Desportes. D'69,782. AHort'70,72. A'71,55. AgR'75,381. B'83,381	Fr	p	l		j		vg	me	Raised by Andre Leroy, of Angers, France.
Henrietta. MagofH'38,231,'45,252,'47,487. Cult'45,174. AgR'54,293. E'54,370, '59,390. D'57,509,'69,782. H164. F273. T'75,548,'85,563,'97,704. Syn. Edward's Henrietta.	Conn	rov	m	gyru	jm	s	g	me	Raised by Governor Edwards, of New Haven, Conn.
Henriette. D'57,508,'69,782. E'59,390. Syns. Belle Henriette, Henriette Bouvier, Henriette d'Orleans.	Belg	rob	m	gybru	cojm	sp	g-vg	ml	Raised by M. Simon Bouvier, of Jodoigne, Belgium.
Henriette Bouvier. D'69,782. Syn. of Henriette									
Henriette d'Orleans. D'69,782. Syn. of Henriette									
Henri Ledocte. EFABC'00. Syn. of Ledocte									
Henri Nicaise. MagofH'53,109. Syn. of Nicaise									
Henri Quatre. Pr202. K'32,176,'41,147. GenF'33,197. Cult'39,66. MagofH'46,173. E'54,372,'59,390. D'57,507,'69,782. F280. Dap155. A'75,68. T'75,548,'85,563,'97,704. Syn. of Henry IV.									
Henri Van Mons. K'32,177,'41,147. MagofH'59,500. Hort'61,219. D'69,782. F'75,548,'85,563,'97,704. Syns. Baron de Geer, Bergamotte Rouge Tardif, Beurre Rouge Tardif, Fleur de Neige, Snow Flower.	Belg	ap	ml	yru	jm	s	g vg	m	One of Van Mons' early seedlings.
Henri Van Mons (erroneously). D'69,727. Syn. of Lamy									
Henry. Cult'45,175	Conn								Originated by Governor Edwards, of New Haven, Conn.
Henry. IllH'95,302,303,'96,52,186,194,207. OH'01,29. AJC'02. Syn. of Henry (of Ill.)									
Henry de Bivort. MagofH'55,189. Syn. of Henry Bivort									
Henry Desportes. MassH'71,40. MichH'75,89							vg	e	Probably the same as Henri Desportes.
Henry Fourth. K'32,176,'41,147. M'38,76,'44,62,'47,67. IndF'40,182. Wg71. Syn. of Henry IV.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Henry IV. M'38,76. D'45,393. MagofH'46,173. Cole159. B'51,305. AgR'54,245. F280. T'85,294. Syns. Ananas, Beurre Ananas, Favori Musque, Favori Musque du Conseiller, Henri Quatre, Henry Fourth, Henry Quatre, Henry the Fourth, Jacquin Jaquin, Poire Ananas.	Fr	rp	ms	gy	gjm	p	g-vg	me	Tree hardy and productive.
Henry IV (incorrectly). AgR'36,365. A'75,68. Dap155. Syn. of Ananas									
Henry (of Ill.). St. Syn. Henry			l					l	Supposed to be a seedling of Vicar; Illinois Horticultural Society's Report, 1895, p. 302.
Henry Quatre. MagofH'38,395. D'45,393. Syn. of Henry IV.									
Henry the Fourth. Pr202. D'45,393,'57,507,'69,782. E'54,372,'59,'390. A'62,68. T'75, 276,'85,294,'97,471. B'83,381. Syn. of Henry IV.									
Henzener. EFABC'00									Being tested in the experimental orchard at Agassiz, B. C.
Hepworth. D'69,879. Syn. of Welbeck.									
Herard. L. Syns. La Herard, Laherard	Belg	oblp	m	ygr	jm	sp	vg	me	Originated by Dr. John Van Mons in 1825.
Herault. R. Syns. Herault's Bergamot, Herault d'Angers									In the experimental orchard at Agassiz, B. C.
Herault's Bergamot. EFABC'00. Syn. of Herault									
Herault d'Angers. AndN'95. Syn. of Herault									
Herefordshire Huffcap. CGenX,239. Syn. of Huffcap									
Herl. L. Syns. Besi d'Airy, Besi d'Heri, Besideri, Besidery, Bezi d'Heri, Bezi d'Hery, Bezi de Hery, Bezi Royal, Caraway Pear, De Bordeaux, De Henri, Franzosische Rumelbirne, Rumelbirne, Wilding of Hery.	Fr.?	r	m	gyr	dj	p	g	l	A culinary variety, in use from October to January.
Hericart. MagofH'42,87,'45,333. D'45,394,'57,509,'69,783. A'54,238. E'54,372,'59,390. H165. F280. AgR'58,407. T'75,276,'85,294,'97,471.	Belg	obl	m	yru	bg	ap	g	me	Tree very vigorous and productive.
Hericart de Theury. F280. Syn. of Thury									
Hericart de Thury. MagofH'53,102,'54,138. D'57,509,'69,783. E'59,390. F280. T'75, 548,'85,563,'97,705. Syn. of Thury.									
Hericart de Thusy. F280. Syn. of Thury									
Herkimer. D'69,783. Syns. Earle, Earl Pear	N. Y.	rob	ml	gyr	cojm	s	g	m	Originated on the farm of S. Earl, of Herkimer, N. Y.
Hermansbirne. D'69,850. Syn. of Saint Germain									
Hernandes. K'41,170. MagofH'42,250									Not described.
Heron. R. Syns. Herren, President Heron		obtp	m	yru	bjm	s	vg	m	In the experimental orchard at Agassiz, B. C.
Herr. R. Syn. Herr's Late Winter									Published in Transactions of the Western New York Horticultural Society, 1880, p. 117.
Herren. EFABC'00. Syn. of Heron									
Herrenbirne. AofH'91,296									Newly introduced in 1891.
Herr's Late Winter. WNYH'80,117. Syn. of Herr.									

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Herzog. R. Syn. Colmar Herzog									Published in Magazine of Horticulture, 1855, p. 186.
Herzogin Von Mouchu. AofH'91,296. Syn. of Von Mouchu									
Hessel. GenF'33,197. Cult'39,66. D'45,357,'57,575,'69,783. Hort'49,410. MagofH '51,263. A'54,238. E'54,396,'59,422. H164. F280. AgR'58,407. T'75,548,'85,563,'97, 705. AofH'89,151. Syns. Hasselbirn, Hazel.	Scot	obo	s	yg	j		p	me	
Hewes. A'52,93,'56,88. MagofH'54,269. AgR'56,366									This may be "Hawes" of Mr. Lyon.
Hewes' Winter. D'69,780. T'85,563. Syn. of Hewes									
Heyst d'Angers. EFABC'00									In the experimental orchard at Agassiz, B. C.
Heyst (Eliza). L. Syns. Belle Crainese, Elise d'Heyst, Eliza d'Heyst	Fr.	obtp	m	gybru	jm	sp	g-vg	vl	Introduced and described by Maj. Esperen in 1844.
Heyst (Emile). L. Bul6,8. AHM249. Syn. Emile d'Heyst	Belg.	oblp	l	ybru	bgm	svp	vg-b	l	Named by Maj. Esperen for Emile Berckmans.
Hill. R. Syn. Hill's Fall Butter									Sent by Mr. Ernst, of Cincinnati, to Mr. Hovey, of Boston, in 1844.
Hill's Fall Butter. MagofH'44,168,212. MassH'44,52. Syn. of Hill									
Hingham. D'69,783	Mass	obop	m	yr	jm	v	g	m	Originated in Hingham, Mass.
His Poiteau. D'69,850. Syn. of Menin									
Hocheimer. R. Syn. Hocheimer Butterbirne									Published in Magazine of Horticulture, 1843, p. 131.
Hocheimer Butterbirne. MagofH'43,131. Syn. of Hocheimer									
Hoerenaille. Pr63. D'69,841. Syn. of Ronville									
Hoe Langer Hoe Liever. D'68,864. Syn. of St. Germain (Sum.)									
Hofsta. MHSC'86,82	Swed	p	m				g	m	Charles Gibb called it a fine culinary variety.
Hog. CalSBofH'92,49. Syn. Pera de Coche									Not described.
Hohensaten. CanExFR'00,462. EFABC'00		obtp	m	yb	jb	s	vg	m	Being tested at Agassiz, B. C.
Holland. L. Syns. Bergamotte d'Holland d'Alencon, Holland Green, Holland Table Pear.			l	gru	djm			me	An old variety described by Coxe as Holland Green.
Holland Bergamot. C208. Pr73. GenF'37,278. K'41,126. D'45,430,'57,564,'69,784. H166. F389. T'75,548,'85,564,'97,705. Syn. of Hollande.									
Hollande. L. Syns. Amoselle, Bergamotte d'Alencon, Bergamotte de Fougere, Bergamotte d'Hiver d'Holland, Bergamotte d'Holland, Bergamotte d'Hollande, Beurre d'Alencon, Beurre Extra, Holland Bergamot, Hollande Bergamotte, Hollandische Bergamotte, Jardin de Jougers, Lord Cheney, Lord Cheeney's, Musquine de Bretagne, Pensionaire de Hollande, Sarah.		r	l	gbru	cj	sp	g	vl	A fine culinary variety; will keep until May or June.
Hollande Bergamotte. K'32,146. H160. F277. E'59,417. D'69,784. Syn. of Hollande.									
Holland Fig. EFABC'00									Being tested in experimental orchard at Agassiz, B. C.
Holland Green. C190. SW. K'32,137,'41,127. MagofH'37,51. IndF'40,136. H165. D'69,784. Syn. of Holland.									
Hollandische Bergamotte. D'69,784. Syn. of Hollande									
Holland Table Pear. C190. K'32,137,'41,127. H165. D'69,784. Syn. of Holland.									
Holmar. Pr209. Syn. of Holmore									
Holmer. Pr209. Syn. of Holmore									
Holmore. Pr209. GenF'37,218. CGenX,239. Syns. Holmar, Holmer, New Holmar.	Eng.	r	s	gyr					Mainly grown for the manufacture of perry.
Holy Father. Pr113. Syn. of Saint Pere									
Holzfarbige Butterbirne. MHSC'82,58. FGAofO'83,222. Syn. of Fondante de Bois.									
Homestead. Dap150. MassH'77,80	Mass	oblp	ml	gybru	cojm	spo		ml	Raised by Asahel Foote from seed of White Doyenne.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Homewood. Hort'63,176. OH'65,41,'66,58. D'69,771. FGAofO'74,12. A'77,50. B'83,381. Syn. of General Taylor.									
Honey. Pr216. M'38,68. MagofH'43,131. E'54,327,'59,391. H166. D'69,784. EFABC'00. Syns. Honey, European. Honey, American	Amer. Eur.	rp	ms	yrru	coj	s	g	me	An old variety of doubtful origin.
Honey American? L17. Syn. of Honey.									
Honey (Russ.). Gb. CanExFR'96,136,'03,421. Syn. Gliva Medovaya (Honigbirne)	Rus.	rp	m	yrb	coj	s	.....	me	Introduced from Russia in 1879.
Honey Sweet. FGAofO'93,146									Not described.
Hons. L. Syn. Monseigneur des Hons	Fr.	oblp	m	ygr	m	ps	.....	me	Received from Troyes, France.
Hooper's Bilboa. MagofH'38,390. D'45,362,'57,461,'69,773. HovI,99. E'54,326,'59,337. T'75,548,'85,564,'97,705. Syn. of Bilboa.									
Hoosac. MassH'74,158. A'87,95. OH'87,166. IllH'87,50. Syn. of Hoosic									
Hoosic. Dap177. B'83,370. T'85,564,'97,705. HAJ'88. WNYH'80,116,'81,20. GHM&S'90. E&B'02. AHM249. Syns. Hacon's Seedling No. 3, Hoosac.	Mass.	robtp	l	gyru	jm	p	vg	m	Raised by Asahel Foote from seed of Hacon.
Hoosier. IndF'40,105	Ind.		ml						Exhibited by James Sigerson at meeting of Indiana Horticultural Society, August, 1840.
Horace Greeley. Dap150. Syn. of Greeley.									
Horimer. R. Syn. Beurre Canton Horimer									Not described.
Horn. BBL. Syns. Horn's Seedling, Horn's Winter									Shown at World's Columbian Exposition, 1893, by Illinois Horticultural Society.
Horn's Seedling. IllH'93,76. Syn. of Horn									
Horn's Winter. IllH'96,204,215. Syn. of Horn									
Horticulture. MassH'44,61. MagofH'50,296. A'54,238									Rejected by Congress of Fruit Growers, 1849.
Hortoles. L. Syn. Professor Hortoles	Fr.	robp	ml	yrubr	djm	sv	b	m	Originated with M. Morel at Lyons, France.
Hosea-Schenck. IllH'80,14. Syn. of Hosenschenck									
Hosenschenck. Hort'53,458,'75,275. E'54,372,'59,391. H188. F271. A'62,112. AJofHVIII,223. D'69,784. IllH'81,200. Syns. Butter Pear, Eshleman, Hosea-Schenck, Hosenshenck, Hosen Shenk, Moore, Moore's, Moore's Pear, Moore's Pound, Moor's Pound, Moore's White Pound, Queen of August, Schenck's August, Schenck's August Watermelon, Schenk, Schenck's Pear, Shenks, Smokehouse, Watermelon.	Pa.	rob	m	ygr	coj dm	v	g-vg	me	Originated on the farm of John Schenck in Weaver Township, Pa.
Hosenshenck. MagofH'53,462. E'54,372. D'57,508,'69,784. T'85,296,'97,705. Syn. of Hosenschenck.									
Hosen Skenk. MagofH'53,499. Syn. of Hosenschenck									
Hoskins. R. Syn. Dr. Hoskins									Not described.
Housatonic. Dap151	Conn.	rp	ml	gy	jm	v	.....	m	Originated by Dr. J. J. Howe, of Birmingham, Conn.
Houser. MoH'96,38									Mentioned by Judge Miller in Missouri Horticultural Society, 1896, p. 36.

Hovey. MagofH'54,235. D'57,509,'69,784. F280. E'59,391. T'75,548,'85,564'97,705. Syn. Doyenne Hovey.	Fr	obtp	ml	ygru	bjm	sp	vg	m	Raised by Andre Leroy and named for C. M. Hovey.
Hovey. MassH'60,50. Syn. of Danas Hovey									
Hovey Dana's. A'62,68. Syn. of Danas Hovey									
Howard. A'67,150. D'69,785	Conn	robo	m	yru	jm	sp	vg	me	Received from C. W. Coit, of Norwich, Conn.
Howe. L. Syn. Doctor Victor Howe	Conn	robtp	m	gyru	jm	sv		m	Originated by Dr. J. J. Howe, of Birmingham, Conn.
Howell. MagofH'49,69. Hort'51,115,'55,350,'70,175,'72,245,'73,168. HovII,75. WHRIV,448. B'51,306,'83,370. E'54,372,'59,340. AgR'54,245,'66,134. D'57,510, '69,785. H166. F246. T'75,276,'85,294,'97,471. HMHS285. WnI,335. Syn. Howell's Seedling.	Conn	rp	l	yr	jm	v	vg	m	Raised by Thos. Howell, of New Haven, Conn., in 1842.
Howell's Seedling. MagofH'48,519. Syn. of Howell									
Howe No. 12. A'73,68. [Originated by Dr. J. J. Howe, of Birmingham, Conn.]									
Howe No. 20. A'73,68. [Originated by Dr. J. J. Howe, of Birmingham, Conn.]									
Howe. (Win.). L. Syn. Howe's Winter	Va	r	l	yru			g	l	Said to have originated in Virginia.
Howe's Winter. F273. Syn. of Howe (Win.)									Published in the Cultivator, 1847, p. 340.
Howland. R. Syn. Howland's Winter									Published in the Cultivator, 1847, p. 340.
Howland's Winter. Cult'47,340. Syn. of Howland									
Hoyerswerda. L. Syns. Green Summer Sugar, Green Summer Sugar Pear of Hogerswerda, Sucre de Hoyerswerda, Sugar d'Hoyerswerda, Sucre Noir d'Ete, Sugar of Hoyerswerda, Sucre Vert d'Hoyerswerda, Sugar Pear of Hoyerswerda.	Ger	rp	s	yg	j	s	g p	me	Pleasant and of peculiar flavor, but not valuable.
Hubard. D'69,678. Syn. of Amanlis									
Hubert. R. Syn. Saint Hubert Rousset									Published in Magazine of Horticulture, 1843, p. 131; not described.
Huffcap Pr209. GenF'37,278. CGenX,239. Syn. Herefordshire Huffcap	Eng	ovate	m	gru					Grown almost solely for perry.
Huggard. R. Syn. Huggard's Seedling	Can.	obtp	l	yrb	j	s	g	ml	A cross between Clairgeau and Anjou. Originated at Whitby, Ontario.
Huggard's Seedling. CanH'99,511. Syn. of Huggard									
Hugo. R. Syn. Victor Hugo									In the trial orchard at Agassiz, B. C.
Huguenot D'45,394,'57,575,'69,786. APC'50,11. MagofH'51,263. A'54,238. E'54,396, '59,422. F273. T'75,549,'85,564.	Mass	r	m	yr	cog	s	g	m	Originated by Mr. Johonnot, at Salem, Mass.
Hull. MagofH'43,432,'44,211. MassH'43,4,47,'48,101. D'45,394,'57,575,'69,786. Cole 160. B'51,317. HovI,5. E'54,372,'59,391. H166. F273. AgR'58,420. A'62,68. T'75,276,'85,294,'97,472.	Mass	obtp	m	gyru	jm	v	vg	me	Originated in 1804 in the town of Swansea, Mass.
Hultem. R. Syn. Van Hultem									Published in Magazine of Horticulture, 1855, p. 146.
Humboldt's Butterbirne. Dap155. Syn. of Bosc									
Humbug. MagofH'49,43	Conn								Raised by Governor Edwards, of New Haven, Conn.
Hungerford. L. Syn Hungerford's Oswego	N. Y	r	m	yb	bjmg	s	g	m	Cultivated at Oswego, N. Y.
Hungerford's Oswego. D'69,786. Syn. of Hungerford									
Hunt. L. Syn. Hunt's Connecticut	Am	obl	m	yg	co	s			A valuable culinary variety.
Hunt's Connecticut. M'44,91,'47,93. MagofH'46,305. A'54,238. D'57,575,'69,786. T'75,549,'85,564,'97,705. Syn. of Hunt.									
Hunter. D'69,735. Syn. of Chasseurs									
Huntingdon. D'69,797. Syn. of Lammas									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Huntington. Hort'56,509,'57,113. A'56,197. MagofH'57,111. D'57.511,'69,786. F'273. E'59,391. GenIX,191. T'75,284,'85,302,'97,476.	N. Y...	rob	ms	yeru	jrmb	sv	vg	me	Originated at New Rochelle, N. Y. Brought to notice by S. P. Carpenter.
Huron. Hort'56,184. Hof. D'69,855. Syn. of Sheldon									
Hutcherson EFABC'00. CanExFR'03,420		obp	m	gy	jm	s		me	In the experimental orchard at Agassiz, B. C.
Hutin. R. Syn. Madame Hutin									In the experimental orchard at Agassiz, B. C.
Huy. R. Syn. Delices de Huy									In the experimental orchard at Agassiz, B. C.
Huyshe's Bergamot. MagofH'58,276. D'69,787. EFABC'00. Syn. of Huyshe Prince.									
Huyshe Prince. L. Syns. Huyshe's Bergamot, Huyshe's Prince of Wales	Eng	rov	l	yeru	dmj	v		l	Originated by Rev. John Huyshe, of Clythedon, England.
Huyshe's Prince Consort. Hort'67,124. D'69,786. T'75,549,'85,564,'97,705. Syn. of Consort.									
Huyshe's Prince of Wales. Hort'67,124. D'69,787. A'71,55. Syn. of Huyshe Prince.									
Huyshe Princess. L. Syns. Huyshe's Princess of Wales, Princess of Wales	Eng	obl	m	yeru	gmj	a		m	Originated by Rev. John Huyshe, of Clythedon, England.
Huyshe's Princess of Wales. Hort'67,124. D'69,787. Syn. of Huyshe Princess									
Huyshe Victoria. L. Syn. Huyshe's Victoria	Eng	ovp	m	yru	jm	v	g vg		Originated by Rev. John Huyshe, of Clythedon, England.
Huyshe's Victoria. Hort'67,124. AJofH111,112,VII,182. AHortA'68,80,'69,79,'70,77. D'69,787. AgR'75,378. Syn. of Huyshe Victoria.									
Hyacinth. EFABC'00									In the experimental orchard at Agassiz, B. C.
Ice Pear. Tr87. D'69,877. Syn. of Virgouleuse									
Ickworth. K'32,194,'41,162	Eng				m			vl	Originated by Thomas Andrew Knight. Sent to America in 1832.
Idaho. HAJ'87,'88,14. AgR'88,572. A'89,169. CanH'89,2,'94,33. AofH'89,103,151. WnI,332,II,341. IllH'90,117,'92,172,'94,137. N253. AHM249. T'97,477. Syns. Lindsay, Mulky.	Idaho	r	l	y	bm		vg		Formally introduced in 1889. See Annals of Horticulture, 1889, p. 130.
Immense. L. Syn. Immense Bis d'Ete									Not described.
Immense Bis d'Ete. K'41,170. MagofH'42,250. Syn. of Immense									
Imperatrice. D'69,829. Syn. of Passe Colmar									
Imperatrice d'Ete. MagofH'43,131. K'41,130									Classed as an "outcast" by Kenrick, 1841, p. 130.
Imperatrice de France. Pr133. GenF'33,196. K'41,175. D'45,386,'57,438,'69,761. HovI,51. E'54,324,'59,337. F210,280. AgR'62,184. T'75,549,'85,564,'97,705. Syn. of Flemish.									
Imperatrice de la France. K'32,172. Syn. of Flemish									
Imperial. DomEncIV,185. GarCal587. SW. Pr116. D'69,822. Syn. of Oak-Leaf									

Imperiale. Pr116. Syn. of Oak-Leaf									
Imperiale a feuilles de Chane. C206. Pr116. K'32,146,'41,126. MagofH'43,131. D-'69,822. Syn. of Oak-Leaf.									
Imperial Oak-leaved. WmPr10. Pr116. K'32,146,'41,126. IndF'40,136. F281. D'69, 822. Syn. of Oak-Leaf.									
126 **Incommunicable.** Pr203. K'32,178. MagofH'43,131. D'69,787. Syn. L'Incommunicable.	Fl.	obtp	ml	gru	gm	s		m	An old variety described by Lindley.
Incomparable. L. Syn. Oswego Incomparable	N. Y.	obop	ml	yeru	jm	s	g	me	Originated at Oswego, N. Y.
Incomparable. K'32,144,'41,125. GenF'33,196,'37,278. MagofH'42,60. D'45,434,'57, 570,'69,723. E'54,393,'59,420. Syn. of Colmar.									
Incomparable de Beauraing. GarM'72,27. Syn. of Beauraing									
Incomparable Hacon's. F280. Syn. of Hacon									
Inconnue. L. LFABC'00. Syns. Inconnue Van Mons, L'Inconnue	Belg.	ovp	ms	yru	jm	s	g vg	vl	Originated by Dr. John Van Mons.
Inconnue Argentine. MagofH'43,131. Syn. of Argentine									
Inconnue Chenau. Pr65. Syn. of Brest									
Inconnue Cheneau. K'32,127,'41,120. Syn. of Brest									
Inconnue Cramoisine. MagofH'43,131. Syn. of October									
Inconnue de Chenneau. MagofH'43,131. Syn. of Brest									
Inconnue de Chesneau. F280. Syn. of Brest									
Inconnue la Fare. Pr95. K'32 148,'41 123. GenF'33 197. D'57 548,'69 850. F282. Syn. of Saint Germain.									
Inconnue Lillie. MagofH'43,131. Syn. of Lillie									
Inconnue Van Mons. NAPC'49,38. B'51,317. Hort'51,113. MagofH'51,67,439,'53, 103. AgR'53,282. E'54,372,'59,391. H166. F281. D'57,511,'69,787. T'75,288,'85,306, '97,480. Syn. of Inconnue.									
Inconstant. D'69,788. Syn. L'Inconstant		ovobo	m	yeru	jm	a	g	m	
Indian. L. Syn. Indian Queen	Me.	p	lm	yrru	cojm	s	p	me	
Indian Queen. MassH'70,32,'71,42,'74,153. MeP73,44,'77,12. Dap127. T'75,549,'85, 564,'97,705. A'75,66. Syn. of Indian.									
Inexagore. R. Syn. Belle Inexagore	For?		vl				vg		Published in the Horticulturist, 1857, p. 189.
Ingendal. L. Syn. Fondante d'Ingendal		ap	s	gyb	jm	sap	vg	me	
Innominee. Pr213. K'32,155,'41,168. Syns Inominee Patrie, L'Innominee, Pyrus Innominata.		p	vl	gy	m	sp	g	me	
Innominee Patrie. MagofH'53,40. Syn. of Innominee									
Invalides. L. Syns. Beurre de Printemps, Colmar des Invalides, Colmar Van Mons, Gros Colmar Van Mons, Poire des Invalides, Va Deux Ans.	Belg.	obtp	l	yeru	cojb	s		vl	Raised at Enghien in 1808.
Ipswich. R. Syn. Ipswich Holland									Rejected by Congress of Fruit Growers, 1849.
Ipswich Holland. MagofH'50,296. A'54,238. Syn. of Ipswich									
Ira Greer. BBL. Syn. of Greer									
Iris. L. Syn. Iris Gregoire	Belg.	oblp	ml	yrru	gmb	sp		l	From the Annals of Pomology.
Iris Gregoire. MagofH'57,155. D'69,788. Syn. of Iris									
Iron. K'32,151,'41,129. MassH'37,37. MagofH'38,394. Hort'46,240. Cole174. E'54, 318,'59,333. D'69,702. HMHS15. Syn. of Worcester.									
Isaac Wolson. JSK'98,'01. Syn. of Crow									
Isabella. MassH'66,46. AJofHIV,344. D,69,788. A'69,101. AHortA'69,79	Mass.	p	m	gr	j	sp		m	Raised by Dr. S. A. Shurtleff, of Brookline, Mass.
Jambert. K'32,135. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. E'54,350,'59,360. F238. Syn. of Brown.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture	Flavor.	Quality.	Season.	Remarks.
Isambert le Bon. GenF'33,196. D'45,357,'57,471,'69,710. E'54,350,'59,360. F277. Syn. of Brown.									
Isambert of Normandy. Pr49. Syn. of Brown									
Isaure. L. Syn. Saint Isaure	For								Published by Field, p. 282; not described.
Island. Hort'58,221,'72,130. A'58,196,'62,117. F273. E'59,392	N. Y.	rp	m	yru	gjm	sp	g	m	Originated at New Utrecht, Long Island, N. Y.
Italian Rich Field. Pr114. Syn. of Italie									
Italie. L. Syns. Champe Riche d'Italie, Itailan Rich Field, Riche d'Italie			ml	g	co		g	l	
Ives. A'58,92. Syn. Ives' Pear	Conn	ovoblp	s	gbr	jm	s	g	me	Originated with Dr. Eli Ives, of New Haven, Conn.
Ives August. L. Syn. Ives' August	Conn	obtp	m	gbr	jm	a	g	me	Originated with Dr. Eli Ives, of New Haven, Conn.
Ives' August. D'69,788. Syn. of Ives August									
Ives Bergamot. T'75,549,'85,564,'97,705. Syn. Ives' Bergamotte	Conn								Originated with Dr. Eli Ives, of New Haven, Conn.
Ives' Bergamot. Pr74. GenF'33,196,'37,277. HovI,77. E'54,369. F273,277. Syn. of Gansel Bergamot.									
Ives's Bergamot. D'45,366,'57,457,'69,769. HovII,77. E'54,369,'59,384. Syn. of Gansel Bergamot.									
Ives' Bergamotte. D'57,512,'69,788. E'59,392. Syn. of Ives Bergamot									
Ives' Pear. D'57,512,'69,788. F273. E'59,392. T'75,549,'85,564,'97,705. Syn. of Ives.									
Ives Seedling. L. Syn. Ives' Seedling	Conn	r	ms	gyc	cogjm	sp	g	me	Originated with Dr. Eli Ives, of New Haven, Conn.
Ives' Seedling. D'57,512,'69,789. F273. E'59,392. T'75,549,'85,564,'97,705. Syn. of Ives Seedling.									
Ives Virgalieu. L. Syn. Ives' Virgalieu	Conn	ap	ms	gc	cogjm	sv	g	m	Originated with Dr. Eli Ives, of New Haven, Conn.
Ives' Virgalieu. D'57,512,'69,789. .F273. E'59,392. T'75,549,'85,564,'97,705. Syn. of Ives Virgalieu.									
Ives Winter. L. Syn. Ives' Winter	Conn	p	m	yru	cog			l	Originated with Dr. Eli Ives, of New Haven, Conn.
Ives' Winter. D'57,575,'69,789. F273. T'75,549,'85.564,'97,705. Syn. of Ives Winter.									
Ives' Yale. D'69,789. Syn. of Yale									
Ixelles. R. Syn. Belle d'Ixelles			l	gy	m	p		l	Published by Magazine of Horticulture, 1860, p. 218. May be Easter Beurre.
I. X. L. EFABC'00									In the experimental orchard at Agassiz, B. C.
Jackman's Melting. M'38,72,'44 57. D'45,396,'57,576,'69 794. E'54,374,'59,394. T'75, 549,'85,564,'97,705. Syn. of King (Edw.).									
Jackson. D'57,512,'69,789. F273. E'59,392. T'75,549,'85,564,'97,705. A'62,110. Syn. Jackson (of N. H.).	N. H.	obop	m	yru	j	v	g-vg	me	A native of New Hampshire.

Jackson. MassH'43,5. MagofH'45,437,'49,43. Syn. of Jackson (Conn.)									
Jackson. D'69,789. Syn. of Mrs. Jackson									
Jackson (Conn.). R. Syn. of Jackson									Published in Magazine of Horticulture, 1845, p. 437, as Jackson.
Jackson's Eliza. OH'75,6. Syn. of Mrs. Jackson									
Jackson's Elizabeth. OH'64,14,'87,94. D'69,789. A'75,68. Syn. of Mrs. Jackson									
Jackson (of N. H.). OH'64,14. Syn. of Jackson									
Jackson's Seckel. A'75,68. Dap155. Syn. of Mrs. Jackson									
Jackson's Seedling. E'59,392. Syn. of Mrs. Jackson									
Jacob. MagofH'52,419. A'54,238. Syns. Beurre Jacob, Jacob's Beurre	Mass								Grown by Col. M. P. Wilder. Perhaps the same as Dr. Jacob.
Jacob's Beurre. EFABC'00. Syn. of Jacob									
Jacquemine F281	For								Published by Field; not described.
Jacques Chamaret. Dap127. Syn. of Chamaret									
Jacques Molet. NYC'90. E&B'94									Not described.
Jacquin. D'45,393. E'54,372. Syn. of Henry IV									
Jagdbirne. D'45,435,'57,572,'69,753. E'54,367,'59,381. F280. Syn. of Echasserie									
Jalais. L. Syns. Beurre de Jalais, Bonne de Jalais	Fr	rp	m	yr	djm	as	g	m	Originated at Nantes, France, in 1857.
Jallai Ballarde. MagofH'43,131. Syn. of Ballard									
Jalousie. K'32,137,'41,121. MagofH'43,131. A'54,238. Syn. Poire de Jalousie									Not described.
Jalousie (Belg.). Pr67. M'38,73,'44,60. D'45,395,'57,576,'69,790. Cole163. E'54,396. '59,422. H167. T'75,549,'85,564,'97,705. Syns. De Pucelle, Jealousy.	Belg	robop	ml	ru	cod	s	g	me	
Jalousie de Fontenay. D'69,790. MHSC'76,29. EFABC'00. Syn. of Fontenay									
Jalousie de Fontenay Vendee. K'41,147. MagofH'42,58,'49,200. D'45,396,'57,512,'69,790. B'51,317,'83,381. AgR'54,245,'64,143. E'54,328,'59,340. H167. Hort'62,472. A'62,68. T'75,276,'85,294,'97,472. Syn. of Fontenay.									
Jalousie Fontenay Vendee. Hort'55,66. AgR'56,366. WnI,333,II,342. Syn. of Fontenay.									
Jalousie Tardive. F281	For								Not described.
Jalvie. MagofH'46,339. F281	For		l		m		g	vl	Briefly described in Magazine of Horticulture, 1846, p. 339.
James. MagofH'43,131									This is probably "Polk" of Magazine of Horticulture, 1845, p. 252.
Jas. de Milnes. ArizB15. Syn. of Milnes									
James K. Polk. MassH'43,5. Syn. of Polk									
Jas. Taylor Pear. MagofH'47,157. Syn. of Taylor									
Jamin. D'57,494,'69,747. F283. Syn. of Brabant									
Jaminette. K'32,195,'41,162. M'44,90,'47,92. D'45,438,'57,513,'69,790. E'54,372,'59,392. H166. F281. A'62,68. Hort'67,76,'75,275. T'75,288,'85,306,'97,480. WnI,333,II,342. Syns. Belle d'Austrasie, Bergamotte Cheminette, Beurre d'Austrasie, Beurree d'Austrasie, Beurre Saint Helier, Colmar Jaminette, Crassane d'Austrasie, D'Austrasie, Hardenpont du printemps (of some), Jaminette d'Hiver, Josephine, Pirolle Maroi, Poire d'Austrasie, Sabine, Sabine d'Hiver, Sabine (of the French), Sabine Van Mons, Tyrolle, Wilhelmina, Wilhelmine.	Fr	obo	ml	ybru	jb	s	g-vg	l	Raised by M. Jaminette, of Metz, France.
Jaminette d'Hiver. K'41,170. MagofH'42,250. Syn. of Jaminette									
Janet. R. Syn. Red Janet									Published by Magazine of Horticulture, 1843, p. 131.
Jansenns. F281	For								Published by Field; not described.
Janvier. L. Syns. Doyenne Janvier, Rousselet de Janvier	Belg	obop	s	y	dbm	p	....	l	From the report of the Society of Van Mons.
Janery. D'69,858. Syn. of Spanish									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Japan. Hort'68,71,'69,261,'72,192. D'69,790. A'69,51. AHortA'69,79. IaH'79,401. IllH'70,297. NYC'90. Syn. Japan Pear.	N. J....	ob	m	cyru	cog	v	......	ml	Raised by Gideon Ross, of Westfield, N. J.
Japanese. Bl229,244. Syn. of Cincincis									
Japanese. Bl229,244. Syn. of Daimyo									
Japanese. Bl229,244. Syn. of Mikado									
Japan Golden. IllH'99,207. Syn. of Golden Russet									
Japan Golden Russet. AofH'91,296. IllH'92,173,'98,155,'99,102. C(O)HS'91,21. IaH'94,170. OH'97,13,'98,8. T'97,706. AHM249. Syn. of Golden Russet.									
Japan Pear. AHortA'70,77. Syn. of Japan									
Japan Russet. AHM249. Syn. of Golden Russet									
Japan Seedless. A of H'91,296									Possibly a distinct variety.
Japan Select. SBro									Cultivated by Stark Bros., of Missouri.
Jaquin. D'57,507,'69,782. E'54,372,'59,390. F280. A'75,68. Dap155. Syn. of Henry IV.									
Jardin. K'41,124. Syns. Poire de Jardin, Poirier de Jardin		obl	m	yr	comg	s	g	l	
Jardin de Jougers. D'57,564,'69,784. F277. Syn. of Hollande									
Jargonelle. GarCal587. WPrs. Wg71. AofH'89,151,'91,296									May be Jargonelle (Eng.).
Jargonelle. Pr59. Syn. of Bon Chretien (Sum.)									
Jargonelle. C183. K'32,128. AgR'54,242. E'54,373,'59,393. Syn. of Jargonelle (Eng.).									
Jargonelle Cuisse Madame (Eng.). Pr154. Syn. of Jargonelle (Fr.)									
Jargonelle de Knoop. D'69,758. Syn. of Jargonelle (Eng.)									
Jargonelle des Provencaux. D'69,864. Syn. of St. Germain (Sum.)									
Jargonelle (Eng.). Th187. Pr152. GenF'33,197,'37,277. Cult'39,66. MagofH'43,363. Hort'49,410,'55,65. Cole 152. B'51,300. H167. F280. T'75,549,'85,564,'97,706. Syns. Beau Present, Beau Present Espargne, Belle Verge, Beurre de Paris, Certeau Madam, Chandelle, Chopine, Cuillette, Cuisse Madame, English Jargonelle, Epargne, Espargne, Frauenschenkel, Gargonelle, Grosse Cuisse Madame, Grosse Quisse Madame, Jargonelle, Jargonelle de Knoop, Jargonelle (of the English), Lady's Thigh, Lauren's Summer, Long Island Summer, Poire de Tables des Princes, Real Jargonelle, Reserve Pear, Saint Lambert, Saint Sampson, Saint Sanson, Sicile, Sparbirne, Sweet Summer.	Eng....	p	ml	gyb	coj	v	g	me	Variable in quality; sometimes rots at the core.
Jargonelle (Fr.). H167. F280. T'85,564. Syns. Adeux Yeux, Bassin, Beauty of Summer, Belle Comelie, Bellissime d'Ete, Bellissime Jargonelle, Bellissime Supreme, Butler's Harvest, Chaumontel d'Ete, Colby, Cuisse Dame d'Ete, Cuisse Madame, Dorr, English Red Cheek, French Jargonelle, Lusee d'Ete, Jargonelle Cuisse Madame (Eng.), Jargonelle (of the French), Just, Laurentine, Muscadet d'Ete, Poire des Princes, Red Cheek, Red Muscadel, Ridal, Sabine d'Ete, Saint Laurent, Summer Beauty, Summer Jargonelle, Supreme, Udal, Vermilion d'Ete, Windsor.	Fr.?....	obo	m	gyr	cobr	s	g	e	Mr. Thompson, of the Royal Horticultural Society, of London, called this "French Jargonelle" to distinguish it from the variety known in England as "Jargonelle."
Jargonelle of Provence. Pr30. Syn. of St. Germain (Sum.)									

Jargonelle (of the English). K'41,118. D'45,337,'57,514. E'54,373,'59,393. Syn. of Jargonelle (Eng.).									
Jargonelle (of the French). K'32,153,'41,119. D'45,339,'57,514. A'54,239. Syn. of Jargonelle (Fr.).									
Jasmin. K'41,121. Syn. of Frangipane									
Javardel. MassH'45,88.									Exhibited at meeting of Massachusetts Horticultural Society, 1845, by Robert Manning.
Jealousy. Pr.67. Syn. of Jalousie (Belg.)									
Jean Baptiste Bivort. D'69,780. Syn. of Baptiste									
Jean de Witte. MagofH'41,286,'45,372,'54,138. K'41,162. MassH'45,88. E'54,373,'59,393. D'57,515,'69,791. H168. A'54,161,'62,68, T'75,292,'85,564,'97,484. Syn. of Witte.									
Jefferson. D'69,791. PaFS'71,64. Hort'72,130,167. A'73,119,75,'58,150,154,'77,142. MVHS'83,131. GHMAS'90,'94.	Miss Ala	robtp	l	yr	co	p	p	me	Origin in dispute; Downing says Mississippi.
Jenart. D'69,696. Syn. of Rance									
Jergils. E'54,381,'59,410. Syn. of Archangel									
Jersey Gratioli. MagofH'46,337,'52,149,161. E'54,373,'59,393. D'57,515,'69,791. AgR'56,367. H168. T'75,549. Syn. of Gratioli.									
Jeschil. L. Syn. Jeschil Armudi	Eur.	p	m	ygr	......	sp	......	me	A Turkish variety; perhaps of little value.
Jeschil Armudi. K'41,153. MagofH'43,126. Syn. of Jeschil									
Jewess. D'69,796. Syn. of Juive									
Jilogil. D'45,136,'57,574,'69,772. E'54,395,'59,422. Syn. of Gilogil									
Joachim. R. Syn. St. Joachim									In the experimental orchard at Agassiz, B. C.
Joannet. L. Syns. Amire Joannet, Amire Johannet, Archduc d'Ete (erroneously) Joanette, Petit Johannet, Pera de San Juan, Petit St. Jean, St. Jean, St. John, St. John's Pear.	Fr.	p	s	gyr	jd	s	g	e	Mr. Lyon thought it probably the same as Harvest.
Joannet. Pr9. K'32,131. Syn. of Harvest									
Joannette. Pr9. E'54,366,'59,581. Syn. of Harvest									
Joannette. Pr9. D'45,330,'57,450,'69,658. T'75,549,'85,565,'97,706. HHH'84,82. Syn. of Joannet.									
Jodoigne. L. Bul6. Syn. Triomphe de Jodoigne	Belg.	obovp	l	gyeru	cojm	s	g-vg	m	Raised by Mr. Bouvier in 1830; introduced in 1843.
Jodoigne (Delices). L. Syn. Delices de Jodoigne	Belg.	obtp	ml	yberu	jbm	......	g-vg	m	Originated in 1846.
John. MagofH'38,466,'49,43. MassH'43,5.	Conn.								Originated by Governor Edwards, of New Haven, Conn.
John. D'45,143,'57,578,'69,815. E'54,387,'59,423. F281. Syn. of Messire									
John Cotton. MassH'62,32,'65,44,'66,45.	Mass.								Raised by Dr. S. A. Shurtleff, of Brookline, Mass.
John Griffith. D'69,791. Syn. of Griffith									
John Moutich. A'54,239. F281	For.								Not described.
John Williams. A'73,111,'75,37,136	South.						vg	l	An old variety but only recently propagated.
Johonnot. Pr136. K'32,177. MagofH'37,65,'47,484. M'38,74,'44,58,'47,61. D'45,395,'57,515,'69,791. B'51,306. E'54,373,'59,392. H168. AgR'56,366. F273. A'62,68. AJofH'67,42. T'75,276,'85,294,'97,472. Syn. Franklin.	Mass.	r	m	y	mb	......	g	m	Originated in garden of G. S. Johonnot, of Salem, Mass.
Joigneaux. R. Syn. Pierre Joigneaux									In the experimental orchard at Agassiz, B. C.
Joinville. L. Syn. Prince de Joinville	Belg.	r	m	gyru	mj	vsp	......	m	Fruited in 1848. From Album of Pomology.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Sizt.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Jolemont. MagofH'46,367. Syn. of Summer Doyenne									
Jolie Fille de Gust. D'69,792. Syn. of Gust									
Jolimont. D'69,742. Syn. of Summer Doyenne									
Joli-Mont (of some). D'69,864. Syn. of St. Germain (Sum.)									
Jolivet. F281. D'69,742. Syn. of Summer Doyenne									
Jolliemont. MagofH'47,427. D'69,742. Syn. of Summer Doyenne									
Joly de Bonneau. D'69,792. Syn. of Bonneau									
Jonah. MagofH'49,69									Said to be the parent of Howell; see Magazine of Horticulture, 1849, p 70.
Jones. E'59,393. D'69,792. B'83,371. MoH'85,429,'92,236,237 GarM'86,19. MichH'86,422. T'85,310. A'99,15. IllH'02,342. AHM249. Syn. Jones Seedling.	Pa	p	ms	yeru	cogb	sv	vg	m	Originated at Kingsessing, near Philadelphia, Pa.
Jones (Ill.). MoH'87,378. IndH'90,50. A.H'91, 194. IllH'96, 128,'98,336,'02,342	Ill.?								Introduced in 1891, by Mr. Jones of Illinois; see Annals of Horticulture, 1891, p. 194.
Jones's Seedling. B'51,317,'83,371. D'57,515,'69,792. F273. Cult'65,76. IllH'69,155. T'75,292,'85,310,'97,484. WHYN'80,12,'81,118. WnI,333,II,342. CanEx FR'00,462. AHM,249. Syn. of Jones.									
Jonghe Colmar. L. Syn. Colmar de Jonghe	Belg	p	m	gyr	dj	sp		me	Originated with M. J. De Jonghe, of Belgium.
Jonghe Rousselet. L. Syn. Rousselet de Jonghe		obo	S	y	gmj	s		ml	Described by Dr. Hogg, in Fruit Manual.
Joseph. L. Syn. Saint Joseph	For								Published by Field, p. 282; not described.
Josephine. D'45,386. HovI,51. Syn. of Flemish									
Josephine. K'32,195,'41,162. M'44,90,'47,92. D'45,438,'57,513,'69,790. E'54,'372,'59,392. F281. T'75,549,'85,565,'97,706. Syn. of Jaminette.									
Josephine. (Bouv.) L. Syn. Josephine Bouvier	For	ovat	m	gru	cojm	s	p	l	
Josephine Bouvier. D'69,793. Syn. of Josephine (Bouv.)									
Josephine Bouvier. Dap155. Syn. of Navez									
Josephine de Binche. AJofHVII,113. Dap127. EFABC'00. Syn. of Binche									
Josephine de Malines. B'51,310,'83,376. Wg71. AgR'53,282. D'57,516,'69,793. A'62,68. E'54,373,'59,393. H168. AHortA'68,80. IllH'68,96,'69,135. T'75,295,'85,313,'97,485. S91. WNYH'81,118. AHM249. Syn. of Malines.									
Josephine (erroneously). MoH'92,235. Syn. of Malines									
Josephine (incorrectly of some). D'45,427,'57,473,'69,696. Syn. of Rance									
Josephine of Malines. IllH'90,126. Syn. of Malines									
Josephine Von Mecheln. AofH'91,296. Syn. of Mecheln									
Joseph Staquet. D'69,793. Syn. of Staquet									
Jose Smet. R. Syn. Colmar Jose Smet									Published in Magazine of Horticulture, 1855, p. 150; not described.
Jouffroy. D'69,875. Syn. of Vicar									

Jubin. MassH'47,69. A'54,239									In Robert Manning's collection, 1847.
Judge Andrews. D'69,794. Syn of Andrews (Kings.)									
Juicy Gliva. Gb. Syn. Gliva Otschen Sotchnaya	Rus.?								Introduced from Russia in 1879.
Juillet. L. Syn. Coloree de Juillet	Fr.	obtp	ms	ybrm	djg	sp	g	e	Originated at Rouen, France.
Juive. L. Syns. Jewess, La Juive	Belg.	obo	m	yru	cojm	sp	g-vg	m	Introduced by Maj. Esperen.
Jules Bivort. MagofH'54,457. D'57,517,'69,734. F281. E'59,393. T'75,277,'85,295,'97,472. B'83,281. Syn. of Louvenjal.									
Jules d'Airoles (de Leon Leclerc). Dap178. EFABC'00. Syn. of Airoles (Leclerc).									
Jules d'Airoles (de H. Gregoire). Dap178. Syn. of Airoles (Gregoire)									
Julianet. SW. Syn. of Julienne									
Julie. L. Syns. Alexandre Helie, Belle Julie, St. Germain de Graines, St. Germain du Tillay, St. Germain Dutillent, St. Germain du Tilloy, Tilloy.	Belg.	robtp	m	gyru	bjm	spv	g-vg	m	
Julienne. C182. K'32,156,'41,133. M'38,67. IndF'40,182. D'45,339,'57,516,'69,794. Cole154. E'54,373,'59,393. AgR'54,242,249. MagofH'49,450. Hort'55,65,'73,167. H169. F281. T'75,252,'85,270,'97,452. Syns. Bloodgood Pear of New York, Julianna, Julienne (of Coxe), L'Archiduc d'Ete, Summer Beurre, Summer Doyenne (erroneously), Summer St. Michael (so called near Boston).		obo	s	y	bj	s	v	me	An old and formerly popular pear; now generally discarded.
Julienne (of Coxe). GenF'37,277. Syn. of Julienne									
July Doyenne. EFABC'00. CanExFR'03,421		obop	ms	gyr	mj			e	Being tested in the experimental orchard at Agassiz, B. C.
July Pear. MagofH'37,19. D'45,344,'57,582,'69,862. Cole172. E'54,399,'59,421. T'75,549,'85,565,'97,706. Syn. of Sugar Top.									
Junfer. Gb. Syn. Junferbirne	Rus.?								Introduced from Russia in 1882.
Junferbirne. Gb. Syn. of Junfer									
Juradiel. F281	For.								Not described.
Jurie. L. Syn. Auguste Jurie	Fr.	obp	s	yr	mj	v	me	g	Raised by M. Fortune, of Willermoz, France.
Just. D'69,767. Syn. of Jargonelle (Fr.)									
Justine. EFABC'00. Syn. Justine (Peller)									In the experimental orchard at Agassiz, B. C.
Justine (Peller). CanExFR'96,136. Syn. of Justine									
Jutte-birne. D'69,886. Syn. of Yat									
Jut-pear. D'69,886. Syn. of Yat									
Jutte. F281. D'69,886. Syn. of Yat									
Juvardal. MassH'47,69. Syn. Juvardiel									Exhibited by Robert Manning at meeting of Massachusetts Horticultural Society, 1846, p. 151.
Juvardiel. MassH'46,151. AgR'54,243. Syn. of Juvardal									
Kachengheim. R. Syn. Beurre de Kachengheim									Published by Magazine of Horticulture, 1849, p. 389.
Kaiserbirne. P143. GenF'33,196. D'45,378,'57,436,'69,880. F224,279. AgR'62,163. Syn. of White Doyenne.									
Kaiser d'Automne. GenF'33,196. D'45,378,'57,436,'69,880. F279. AgR'62,163. Syn. of White Doyenne.									
K[illegible]. D'69,678. Amandes									
Kalonga. R. Syn. Bon Chretien de Kalonga	Rus.?		l				vg	m	
Kappesbirne (of the Germans). DomEncIV,189. Syn. of Redcap									
Karabudy. MagofH'52,470									Cultivated by Robert Manning in 1852.
Karr. L. Syn. Alphonse Karr	Belg.	obtp	m	yru	dmj	vs		l	Originated by M. Louis Berckmans.
Kartofel. HovH'33. D'57,570,'69,724. F279. Syn. of Aremberg Colmar									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Kattern. Pr20. D'45,343,'57,581,'69,846. E'54,394,'59,421. F281. Syn. of Early Rousselet.									
Katzenkop. D'45,432,'57,568,'69,716. EFABC'00. CanExFR'02,390. Syn. of Catillac.									
Keele Hall Beurre. D'69,861. Syn. of Styrian.									
Keepsake. L. IllH'97,213. Syns. Father's Keepsake, Otcovska.	Rus.?								Introduced from Russia in 1882; not described.
Keiffer. Dap179. IndH'83,47. PaB18. Ha254. IaH'79,304,401. T'85,585,'97,706. N253. Syn. of Kieffer.									
Keiffer's Hybrid. Dap179. IndH'78,64. WNYH'79,53. NJH'82,11,'83,101,110,'86,86,'91,79. Ha254. PaB18. Syn. of Kieffer.									
Keiser. K'32,178. D'69,794. Syn. Keizer.		p	m	ygru	jm	s		m	Described by Lindley.
Keizer. Pr203. Syn. of Keiser.									
Kelsey. Hort'68,393. AHortA'69,79. D'69,794.	Ohio	robo	m	gyru	mb	svp		vl	Originated by Wm. Kelsey, of Columbus, Ohio.
Kemper. SW.									Cultivated by Silas Wharton in 1824.
Kennedy. WnI,332.II,341. CalSBofH'91,74. JB'93. A'95,68.	Cal	robl	sm	ru	tg	s		m	Originated by Gen. Bidwell, at Rancho Chico, Cal.
Kennes. L. T'97,461. Syn. Beurre Kennes.	Belg	rp	m	gyru	bjm	sp	vg	m	Originated by Dr. John Van Mons; described and introduced in 1846.
Kenrick. L. T'97,706. Syns. Buerre Kenrick, No. 1599 of Van Mons.	Fl	p	m	gyru	jb	s	p	me	Originated Dr. John Van Mons.
Kent. L. Syn. Beurre de Kent.									Published by Magazine of Horticulture, 1842, p. 250; not described.
Kentish Beauty. KanH'77,237.									Shown by S. S. Tipton at meeting of Kansas Horticultural Society, September, 1877.
Kentucky. MichSB27. MichB177,187,194. Syns. Kentucky Home, Old Kentucky Home (of Stark Bros.).			s	gy			p	me	Described by Michigan Experiment Station Bulletin 187, p. 74.
Kentucky Home. C(O)HS'91,20. Syn. of Kentucky.									
Kenyon. IaH'04,523,524.	Iowa								Originated at McGregor, Iowa.
Kernel. R. Syn. Belle de Bruxelles Without Kernel.	For								Published by Field, p. 276; not described.
Kessoise. D'69,678. Syn. of Amanlis.									
Ketherd. Mag of H'43,131.									Not described.
Keyports. D'69,771. Syn. of General Taylor.									
Kharkoff. R. Syn. Lemon Kharhoff.									In the trial orchard at Agassiz, B. C.
Kieffer. GarM'80,49. B'83,371. AgR'85,264,'90,99,'91,126,'94,154. WnI,328,II,338, III,260. Bul6,8. Syns. Keiffer, Keiffer's Hybrid. Kieffer's Hybrid.	Pa	rp	ml	yrub	cogj		p	m	Raised by Peter Kieffer, Roxbury, near Philadelphia, Pa.
Kieffer's Hybrid. WNYH'79,53. NJH'82,11,'83,101,110,'86,86,'91,79. B'83,371. HB'03,136. Syn. of Kieffer.									
Kilmer. D'69,823. Syn. of Onondaga.									

Kilwinning. MagofH'43,131									Not described.
Kincaid. IllH'92,172. BBL. Syn. Rogers									In trial collection of Benjamin Buckman, Farmingdale, Ill.
King. D'69,795. FGAofO'75,33. Syn. King's Seedling	N. Y.	robj	ms	gb	com	s	g	m	Originated at Oswego, N. Y.
King Charles. CanExFR'01,547. Syn. King Charles of Wurtemburg		obtp	l	gru	j	sa	g	m	In the experimental orchard at Agassiz, B. C.
King Charles of Wurtemburg. EFABC'00. Syn. of King Charles									
King (Edw.). L. Syns. Jackman's Melting, King Edward's		p	l	yr	bm		vg	m	Received from London (Eng.) Horticultural Society about 1840.
King Edward. EFABC'00									In the experimental orchard at Agassiz, B. C.
King Edward's. K'41,148. D'45,396,'57,576,'69,794. Cole163. E'54,374,'59,394. H170. F281. T'75,549,'85,565,'97,706. Syn. of King (Edw.).									
King Karl. SBros. BBL									In the trial orchard of Benjamin Buckman, Farmingdale, Ill.
King Louis. R. Syn. Great King Lewis									Published by the Cultivator, 1847, p. 340.
King of Summer (erroneously). Pr24. Syn. of Archduke									
King of Summer. D'69,843. Syn. of Summer King									
King of Wurtemburg. F242. D'69,767. Syn. of Wurtemburg									
King Seedling. L. Syn. King's Seedling		obo	m	yg	gj	sp	g	m	
King's Seedling. Cult'50,380. Syn. of King									
King's Seedling. D'57,576,'69,795. F273. T'75,549,'85,565,'97,706. Syn. of King Seedling.									
Kingsessing. MagofH'47,450,'53,453,516. Wg71. MassH'53,21. AgR'54,245. D'57,417,'69,795. H169. F271. A'62,68. Hort'58,371. CGenIX,126. T'75,277,'85,295,'97,472. B'83,382. Syns. Leach's Kingsessing. Leech's Kingsessing.	Pa	obtp	l	gy	cogb jm	sp	g vg	mo	Originated in the family cemetery of Isaac Leech, near Philadelphia, Pa.
King Sobieski. EFABC'00. CanExFR'01,546. Syn. of Sobieski									
Kipp. R. Syn. Kipp's Seedling									In the experimental orchard at Agassiz, B. C.
Kipp's Seedling. EFABC'00. Syn. of Kipp									
Kirkland. BBL									Being tested by Benjamin Buckman, Farmingdale, Ill.
Kirtland. MagofH'50,112,'53,168. Hort'50,476,'54,518,'62,486,'72,59. Cult'50,109. B'51,317,'83,371. E'54,329,'59,341. D'57,440,'69,795. H170. A'62,68. AgR'65,189. T'75,277,'85,295,'97,472. Syns. Beurre Kirtland, Hadley, Kirtland's Beurre, Kirtland's Butter, Kirtland's Seckel, Kirtland's Seedling, Seedling Seckel.	Ohio	obtp	ms	yern	mj	sp	vg	me	Raised by H. T. Kirtland, of Poland, Ohio. Exhibited at New York State Fair, 1848. See Transactions New York Agricultural Society, 1848, p. 108.
Kirtland's Beurre. E'54,329,'59,341. D'57,440,'69,795. AgR'65,189. Syn. of Kirtland.									
Kirtland's Butter. CGenVIII,302. Syn. of Kirtland									
Kirtland's Seckel. MagofH'50,112. E'54,329,'59,341. AgR'56,331. D'57,440,'69,795. A'62,68. T'75,277,'85,295,'97,472. Syn. of Kirtland.									
Kirtland's Seedling. NAPC'49,18. MagofH'50,112. E'54,329. D'57,440,'69,795. CGenVIII,302. AgR'65,189. Syn. of Kirtland.									
Kissing Point. IndH'90,158									Found in Australia by Prof. F. M. Webster; not described.
Kitchen. L. Syns. Kitchen Pear, Poire de Cuisine, Poire de Cuisine de Varin.				ru		a		ml	Cultivated at the Jardin des Plantes, Paris, France.
Kitchen Pear. Pr98. Syn. of Kitchen									
Kleine. R. Syn. Pfalzgrafin Kleine									In the experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
K. L. Forelle. K'41,127. Syn. of Forelle									
Knap. R. Syn. Golden Knap									Published in Magazine of Horticulture, 1843, p. 131.
Knaus. EFABC'00.									In the experimental orchard at Agassiz, B. C.
Knave's pear. Pr84. Syn. of Pendant									
Knevitt's New Swan's Egg. D'45,399. E'54,397,'59,423. Syn. of Swan Egg									
Knight. L. Bul6. Syns. Knight's, Knight's R. I. Seedling, Knight's Seedling	R. I	obp	m	yg	j	s	g	m	Raised by Mr. Knight, of Rhode Island.
Knight Bergamot. R. Syn. Knight's March Bergamot	Eng				b		vg	vl	Said by Barry to be one of his best late keepers.
Knight (Edw.). L. Syn. Knight's Edwards	For								Published by Field; not described.
Knight's. D'69,796. Syn. of Knight									
Knight's Edwards. F284. Syn. of Knight (Edw.)									
Knight Harvest. R. Syn. Knight's Harvest									In the experimental orchard at Agassiz, B. C.
Knight's Harvest. EFABC'00. Syn. of Knight Harvest									
Knight's March Bergamot. B'51,317. Syn. of Knight Bergamot									
Knight's Monarch. GenF'33,197. Cult'39,66. MagofH'42,163,'50,498. D'45,439, '57,576,'69,796. WHRI,131,IV,448. AgR'54,252. E'54,374,'59,394. Cole173. T'75, 550,'85,565,'97,706. Syn. of Monarch (Knight).									
Knight's R. I. Seedling. MagofH'47,449. E'54,329. F273. Syn. of Knight									
Knight's Seedling. MagofH'47,449. Cole157. B'51,306. WHRIV,164. E'54,329. D'57,576,'69,796. H170. F281. T'75,550,'85,565,'97,706. Syn. of Knight.									
Knight's Seedling. Hort'67,43. D'69,840. Syn. of Quinn									
Knox. L. T'97,706. Syns. Beurre Knox, Knox Beurre	Fl.	obl	l	gru	dj	s	g-p	me	Tree vigorous and productive.
Knox Beurre. Pr198. Syn. of Knox									
Koch. L. Syns. Docteur Koch, Doctor Koch	Fr	rp	m	yrru	jm	v	g	m	Originated by Andre Leroy, of Angers, France.
Koftliche von Charneau. AofH'91,286. Syn. of Charneau									
Konge. D'45,347,'57,585,'69,883. E'54,400,'59,425. F283. Syn. of Windsor									
Konigsbirne. R. Syn. Konigsbirne aus der Vendee									Said by Annals of Horticulture, 1891, p. 296, to be newly introduced.
Konigsbirne aus der Vendee. AofH'91,296. Syn. of Konigsbirne									
Koning. L. T'97,706. Syns. Auguste de Maraise, Beurre Conning, Beurre de Conick, Beurre de Koning, Beurre de Konink, Beurre Koninck, Beurre Koning.	Belg.	oblp	m	ygru	jm	v	g-vg	m	Possibly two varieties. See Horticulturist, 1858, p. 75.
Koolstock. EFABC'00. CanExFR'01,546		ap	ml	g	j			me	In the experimental orchard at Agassiz, B. C.
Koonce. IllH'89,159,'93,76,'95,55,'00,253. P'95,37. NJH'95,153. Ia'96,161. T'97,706. A'97,44. AHM251. St.	Ill	p	m	gyb	g		g?	e	Originated in southern Illinois.
Koop's Fondante. MagofH'43,367. Syn. of Franc Real (Sum.)									
Kopertscher. D'69,796. EFABC'00. CanExFR'03,421. Syns. Beurre Prince de Schwartzenberg, Kossertscher, Princerere de Kopertsh, Supreme Coloma.	For	r	ms	gyru	jbm	s	g	m	

Korsun. L. Syn. Korsun's Bergamot	Rus?								Introduced from Russia in 1882.
Korsun's Bergamot. Gb. Syn. of Korsun									
Kositschka. Gb. Syn. Kostotchka	Rus?								Introduced from Russia in 1882.
Kossertscher. D'69,796. Syn. of Kopertscher									
Kossuth. L. T'97,706. Syn. Beurre Kossuth	Belg? Fr?	obtp	l	ygb	dmb	sv	g	m	
Kostotchka. Gb. Syn. of Kositschka									
Kozlof. CanH'94,291	Rus.		m				vg	me	
Kramelsbirne. MagofH'50,296. A'54,239									Rejected by the Congress of Fruit Growers, 1849.
Krasavka. FGAofO'92,108. Syn. of Long									
Krasavka. FGAofO'91,12. Syn. of Panna									
Kratish. EFABC'00. Syn. Beurre Von Kratish									In the experimental orchard at Agassiz, B. C.
Kraus No. 18. MichSB27. MichB205									Received from C. F. Kraus, of New York, in 1895.
Kraus No. 41. MichSB27. MichB187,194									Received from C. F. Kraus, of New York, in 1895.
Kriskaya. R. Syn. Kriskaya Victoriana	Rus.?								Not described.
Kriskaya Victoriana. FGAofO'89,3. Syn. of Kriskaya									
Krivonogof. CanH'94,291	Rus.						g		Tree very hardy at the North.
Kronprinz Ferdinand. K'41,161. D'45,437,'57,503,'69,773. HovI,5. F280. Syn. of Glout Morceau.									
Kronprinz Von Oestreich. D'45,437,'57,503,'69,773. HovI,5. Syn. of Glout Morceau.									
Kruell's Winter. MoH'89,332. AofH'90,202. Syn. of Krull									
Krull. MoH'90,36,112,'92,235,'93,224,226,'00,574,'01,328. A'91,124. AofH'91,194. BBL. OH'01,29. IaH'96,161,'99,86. IllH'96,187. FESofO'01,53. AHM252. SBros. T'97,706. Syns. Kruell's Winter, Krull's Winter, Kuell, Kull.	Mo.							l	Introduced in 1891 by Mr. Mallinckrodt, of Missouri.
Krull's Winter. MoH'88,330,'89,141,273. IllH'90,117. Syn. of Krull									
Krupyanka. Gb	Rus.								Introduced from Russia in 1879.
Krzenetzen. MagofH'47,465									Exhibited by Robert Manning in 1847.
Kuang-li. IaH'81,376. Syn. of Strawberry									
Kuell. MoH'96,38. Syn. of Krull									
Kull. ArizB15. Syn. of Krull									
Kumps. L. Syn. Therese Kumps	Belg.	oblp	m	ybru	dmj	svp		m	Introduced in 1847.
Kursk. L. Syns. Bergamot Kurski, Kursk Bergamot	Rus.								Introduced from Russia in 1879.
Kursk Kaga. IllH'96,178. Syn. of Kurskaya									
Kurskaya. Gb. IaB3. NebH'90,130. MinnH'91,175. IaH'93,198,'94,170. N253. Syns. Gliva Kurskaya, Kursk Kaga.	Rus.								Introduced from Russia in 1879.
Kursk Bergamot. Gb. Syn. of Kursk									
Kvoschtchinskaia. FGAofO'92,97	Rus.								Not described.
L'Archeduc d'Ete. C182. K'32,156,'41,133. GenF'37,277. Syn. of Julienne									
La Belle de Flanders. Pr133. K'32,172,'41,135. GenF'33,196. HovI,51. Syn. of Flemish.									
La Belle Ruth. CanExFR'95,392. EFABC'00									In the experimental orchard at Agassiz, B. C.
La Beurre. K'32,135. Syn. of Brown									
La Bonne Malinaise. HovI,15. E'54,346. F283. D'69,884. Syn. of Winter Nelis.									
La Bonne Malinoise. K'32,199,'41,167. Pr132. GenF'33,197. D'45,450,'57,417. HovI,15. E'54,346,'59,355. AgR'62,190. Syn. of Winter Nelis.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
La Canas. F281. Syn. of Canas									
La Caslebirne. F281. Syn. of Caslebirne									
La Cassolette. K'32,127. Syn. of Cassolette									
Lacepede. R. Syn. Comte de Lacepede									Published in Magazine of Horticulture, 1855, p. 146.
La Coloma. K'32,178,'41,168. Syn. of Coloma									
Lade. L. Syns. Beurre Lade, Beurre Ladec	Belg	oblp	ml	yeru	mj	sp		m	Originated by M. Gregoire-Nelis, of Jodoigne, Belgium.
Ladies' Favorite. MassH'60,50	Mass								Originated by Francis Dana.
Lady Clapp. E&B'94,'02. SBros. IllH'96,178. EFABC'00. AHM252	Mass			y	mj	p	vg	m	Described by Ellwanger & Barry, catalogue, 1894.
Lady Flesh. Pr34. Syn. of Prince									
Lady Lemon. MagofH'43,131									Not described.
Lady Thigh. Pr155. D'69,883. Syn. of Windsor									
Lady's Thigh. Pr152. Syn. of Jargonelle (Eng.)									
Latare. D'69,850. Syn. of Saint Germain									
Lafayette. Hort'62,330. D'69,796	Conn	rp	s	yrub	bjm	s	g	m	
La Fortunee de Paris. D'45,436,'57,573,'69,766. E'54,395,'59,421. Syn. of Fortunee.									
La Fortunee de Parmentier. MagofH'40,46. D'45,436,'57,573,'69,766. E'54,395,'59,421. F280. Syn. of Fortunee.									
La Fourcroy. K'32,195,'41,162. Syn. of Diel									
La France. CanExFR'95,392. AndN'95. IllH 00,208,253. EFABC'00									Added to the trial orchard at Agassiz, B. C., in 1895.
Lageret. IllH'69,156. Syn. Bergamot Lageret	For								Published by Field, p. 277; not described.
La Girardin. D'69,772. Syn. of Gerardin									
La Grillien. GenF'37,278. Syn. of Easter Bergamot									
La Herard. MagofH'52,419. D'57,518,'69,796. H171. F281. T'75,550,'85,565,'97,707. Syn. of Herard.									
Laherard. Hort'53,29. E'54,374,'59,395. Syn. of Herard									
La Juive. MagofH'51,500,'54,457. Hort'54,417. E'54,374,'59,395. D'57,518,'69,796. H171. AJofHVI,203. AHortA'70,77. T'75,550,'85,565,'97,707. Syn. of Juvie.									
Lamarque. L. Syn. Bon Chretien Joseph Lamarque	Belg	oblp	l	ybru	bmj	p		m	Originated in Liege, Belgium.
La Marie. MassH'51,189. MagofH'52,419									Cultivated by Col. M. P. Wilder.
Lamartine. D'69,797. IllH'69,155. Syn. De Lamartine	Fr?	rob	s	gyru	cojm	s	vg	m	
Lambertye. R. Syn. Comte de Lambertye									In the experimental orchard at Agassiz, B. C.
Lambre (Alexandre). L. Syn Alexandre Lambre	Belg	obtp	m	yrubr	j	s	g-vg	ml	Originated by Dr. John Van Mons.
Lambre (Catherine). L. Syns. Catharine Lambree, Catherine Lambre	Belg	oblp	ml	gyr	djm	s	vg	m	Originated by Dr. John Van Mons; introduced by Bivort.
Lammas. Pr193. K'32,156,'41,130. MassH'42,376. Cult'39,66. D'69,797. MichH'77,331. Syn. Huntingdon.	Eng?	p	s	yr	jm		g	me	An old variety described by Lindley.

Lammas (of the Scotch). D'69,729. Syn. of Crawford									
Lamoriciere. E'54,374,'59,395. Syns. General de Lamoriciere, General Lamoriciere.	For	p	m	gyru	bjm	v	g-vg	m	
La Motte. L. T'97,707. Syns. Bein Armudi, Bien Armudi, Besi de la Motte, Beurre Blanc de Jersey, Bezi de la Motte, Bezy de la Motte, Crassane Bergamot (erroneously), De la Motte, Wilding Von Motte.		obr	m	ygru	bgj	sp	g	m	Tree very vigorous and productive.
La Moulinoise. D'69,797	Fr	oblp	l	gybru	jm	sv	vg	me	
Lamy. L. Syns. Beurre Curte, Beurre Curtet, Beurre Cutter, Beurre Quitelet, Bis Curtet, Compte de Lamy, Comte de Lamy, Comte Lamay, Dingler, Henri Van Mons (erroneously), Louis Bose, Marie Louise Nova, Marie Louise (the Second).	Belg	obp	m	ybrm	gbm	s	g	m	Originated in Belgium in 1828.
Lancaster. MassH'75,119,'79,160	Mass	oblp	ml	yrub	cojb		g		Originated with T. S. Lancaster, at Gloucester, Mass.
Lanceolot. L. Syn. Adele Lancelot	Belg	p	ml	gyr			p	m	
Landgraft. BBL									In the trial orchard of Benjamin Buckman, Farmingdale, Ill.
Landry Wilding. Pr124. D'69,753. Syn. of Echasserie									
Langborne. FGAofO'92,108. Syn. of Long									
Langelier. Cult'53,341. CGenH,202. T'85,305,'97,480. Bul6,8. AHM252. Syns Beurre Langelier, Langelier's Beurre, Langelier's Butter.	I. of Jer.	obtp	m	yeru	jmg	v	vg	l	Raised by M. Langelier on the Island of Jersey.
Langelier's Beurre. MagofH'46,336,'57,187. D'69,693. Syn. of Langelier									
Langelier's Butter. E'54,312. Syn. of Langelier									
Langelier's Victoria. D'69,773. Syn. of Glout Morceau									
Lansac. Pr115. K'32,137,'41,121. MagofH'43,131,'50,296. A'54,239. D'69,797. Syns. Dauphine, De Lansac, Green Satin, Satin, Satin Vert.		r	s	yg	m	sp		l	Described by Lindley in 1832.
La Porte. AgR'54,243									Not described.
La Princesse. K'32,130. GenF'37,277. Syn. of Muscat Robert									
La Quintinge. D'69,835. Syn. of Pound									
La Reine. D'69,696. Syn. of Romain									
La Reine d'hyver. DomEncIV,181. Syn. of Winter Queen									
Large Catharine. SW. [Perhaps the same as Early Rousselet]									
Large Cordelier. Pr149. Syn. of Pound									
Large Crimson. Pr19. Syn. of Crimson									
Large Duchess. AlaB30									Classed with oriental varieties by Prof. J. S. Newman.
Large Hativeau of the forest. Pr18. Syn. of Gros Hastiveau									
Large Muscadel. Pr23. Syn. Grosse Muscadelle	Fr	t	s	gru	co	sa		e	Very similar to Muscadelle.
Large Oblong. Pr89. Syn. Grosse Alongee			l	gy				m	Cultivated at the Jardin des Plantes, Paris, France.
Large Round Blanquet. Pr15. D'69,797. Syn. of Round Blanquet									
Large Rousselet. Pr21. E'54,399,'59,424. D'69,843. Syn. of Summer King									
Large Seckel. D'45,355,'57,567,'69,703. E'54,391,'59,368. Syn. of Bleecker									
Large Sugar. Gb. OH'86,75. Syn. Zucherbirne Grosse	Rus								Introduced from Russia in 1882.
Large Sugar (of some). C185. Pr59. D'45,346,'57,583,'69,863. H177. Syn. of Bon Chretien (Sum.).									
Large Sugar Pear. SW. [This may be Bon Chretien (Sum.)]									
Large Summer Bergamot. D'57,565,'69,862. H171. Syn. of Summer Bergamot (Large).									
Large Swan's Egg. Pr147. D'69,779. Syn. of Harrison									
Larissa. MagofH'53,517	Pa		s						Exhibited by Mr. Ladd, of Philadelphia, at meeting of Pennsylvania Horticultural Society, 1853.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Lasalle. R. Syn. Cavalier de La Salle									In the experimental orchard at Agassiz, B. C.
La Savourese. D'69,797. Syn. of Savory									
La Savoureuse. DomEncIV,186. Syn. of Savory									
Las Canas. K'41,170. MagofH'49,197. B'51,307. HovI,71. E'54,374,'59,395. Hort-'55,193. D'57,518,'69,798. H171. T'75,288,'85,306,'97,480. Syn. of Canas.									
Las Cassas. MagofH'42,250									This may be "Canas," "Las Canas" of Downing, 1869, p. 798.
La Soeur Gregoire. D'69,798. Syn. of Soeur									
La Souverain. Pr213. Syn. of Passe Colmar									
Latch. MagofH'54,561. Hort'51,493. A'56,197. D'57,534,'69,832. T'75,550,'85,565,'97,707. Syn. of Philadelphia.									
Late Bartlett. MoH'96,72. BBL. Syn. of Winter Bartlett									
Late Bergamot. Pr99. Syn. of Colmar									
Late Catherine. SW. Pr20. E'54,399,'59,421. D'69,846. Syn. of Rheims									
Late Crassane. EFABC'00									In the experimental orchard at Agassiz, B. C.
Late Deschamps. MassH'47,69									Exhibited by Robert Manning in 1847.
Late Gansel. Hort'49,41. Syn. of Gansel Late									
Late Gansel's Bergamot. Hort'49,41. Syn. of Gansel Late									
Late Green. EFABC'00									In the experimental orchard at Agassiz, B. C.
Late Van Mons. Cult'39,66									Not described.
Late Virgalieu. Pr46. Syn. of Gray Doyenne									
Lathrop. R. Syn. Lathrop's No. 1	Mass							me	Mentioned by T. T. Lyon in Transactions Ohio Horticultural Society, 1885, p. 209.
Lathrop's No. 1. OH'85,209. Syn. of Lathrop									
Lativeau. L. Syn. Gros Lativeau	For								Published by Field, p. 280; not described.
Launay. L. Syn. Beurre de Launay	For								Published by Field, p. 278; not described.
Laure de Glymes. MagofH'52,300,'54,84,'55,517. WHRII,560. MassH'53,19. Hort-'54,80. D'57,518,'69,798. CGenX,398. Cult'58,12. E'59,393. F281. T'75,277,'85,295,'97,472. Syn. of Glymes.									
Laurence. MagofH'43,131. AgR'54,245									This may be a misprint for Lawrence.
Lauren's Summer. Dap155. A'75,68. Syn. of Jargonelle (Eng.)									
Laurentienne. D'69,762. Syn. of Jargonelle (Fr.)									
Laval. L. Syns. Blanc-per-ne, Leon le Clerc, Leon le Clerc de Laval, Leon le Clerc Laval.	Belg	obop	l	yrru	jer	s	g	vl	Raised by Dr. John Van Mons, but very different from Leclerc (Van M.).

Lavalle. A'54,239									Rejected by Congress of Fruit Growers, 1849.
La Vanstalle. K'32,178,'41,168. Syn. of Vanstalle									
La Villaine d'Anjou. Pr42. Syn. of Orange Striped									
La Virguleuse. Pr87. D'69,877. Syn. of Virgouleuse									
Lavnille. L. Syn. Fondante de Lavnille	For.								Published by Field, p. 280; not described.
Lawrence. K'41,169. MagofH'44,36,'46,432. M'44,92,'47,94. D'45,442,'57,440,'69,798. Cole173. B'51,310,'83,376. Wg71. HovII,13. MassH'43,4,43,47. WHRIV,448. E '54,339,'59,340. T'75,288,'85,306,'97,480. S91. Bl229.	N. Y.	obop	m	yru	jm	sp	vg-b	l	Produced fruit in 1840. See Magazine of Horticulture, 1844, p. 212.
Lawson. GarM'85,144,282. MichH'86,333. OH'86,122. IllH'86,180. WnII,335,III, 258. Bl227,229. NJH'93,77. Syn. Comet.	N. Y.		l	rb			p	ve	Recommended for early and near-by markets.
Laxton. R. Syn. Green Pear of Laxton									Published in Magazine of Horticulture, 1843, p. 131.
Leach's Kingsessing. MassH'47,90. Syn. of Kingsessing									
Lebanon. D'69,833. T'75,550 '85,565,'97,707. Syn. of Pinneo									
Le Beurre. Pr46. D'69,745. Syn. of Gray Doyenne									
Le Breton. MagofH'40,506. D'69,798. Syn. of Breton									
Le Brun. D'69,799. Syn. Beurre Lebrun	Fr.	oblp	m	yb	mj	sp		m	Originated in Troy, France.
Lechetraund. Pr31. K'32,127,'41,119. Syn. of Cassolette									
Lechetrion. Pr31. Syn. of Cassolette									
Le Clerc (Amelie). L. Syn. Amelie Le Clerc	Fr.	robtp	m	gyru	jm	sv	g-vg	m	Raised by Dr. Leon Leclerc, of Laval, France.
Leclerc (Angelique). L. Syn. Angelique Leclerc	Fr.	oblp	ml	gyr	comjg	sp		ml	Raised by Dr. Leon Le Clerc, of Laval, France.
Le Clerc (Beurre). L. Syn. Beurre Leon Le Clerc		roblp	ml	yru	bjm	sp	vg	m	
Leclerc (Frederick). L. Syn. Frederick Leclerc	Fr.	oblp	ml	gyru	djm	sp		ml	Described by L. E. Berckmans. Named for Dr. Le Clerc.
Le Clerc (Leon). L. Syns. Leon Le Clerc, Leon Le Clerc Epineux		obo	ml	gyru	co		g	l	A culinary variety.
Le Clerc (Van Mons). L. Syns. Celestin, Louise Bonne de Boulogne, Poire de Boulogne, Van Mons Leon Le Clerc.	Fr.	obl	l	ybru	bm	s	g-vg	m	Originated with Dr. Leon Le Clerc, of Laval, France.
Le Clercq (Lucien). L. Syn. Lucien Leclercq	Belg.	ovate	m	gru	gm	s		m	Originated with Dr. John Van Mons. Fruited in 1844.
Le Conte. GaH'78,8,29,'83,17,'84,9,'85,55. IaH'79,303. Ind H'79,49. AlaB106. B'83, 371. T'85,565,'97,707. GarM'85,283. Bl228. Ha252. WnI,328,II,338,III,260. AH-M253. Syn. Chinese Pear.			l	y			p	me	An oriental hybrid; only valuable at the South.
Le Cure. D'45,448,'57,557,'69,875. Cult'47,340. HovI,47. AgR'54,296,'62,189 E'54, 344,'59,354. H172. B'83,377. T'75,550,'85,565,'97,707. MVHS'83,126. Syn. of Vicar.									
Le Czar. EFABC'00. Syn. Le Czar No. 36									In the experimental orchard at Agassiz, B. C.
Le Czar No. 36. CanExFR'96,136. Syn. of Le Czar									
Ledeberg. R. Syn. Fondante de Ledeberg									In the experimental orchard at Agassiz, B. C.
Lederbirne. MassH'45,89. MagofH'50,296. A'54,239									Rejected by the Congress of Fruit Growers, 1849.
Ledocte. R. Syn. Henri Ledocte									In the experimental orchard at Agassiz, B. C.
Lee. D'69,799. Syn. Lee's Seedling	Mass.	rov	sm	grub	jco		p	me	Originated at Salem, Mass. Described by Elliott.
L'Echasserie. C205. Pr124. K'32,144. H171. D'69,753. Syn. of Echasserie									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Leech's Kingsessing. Hort'48,326. Cole159. B'51,300,'83,382. AgR'54,251. E54,374,'59,394. D'57,517,'69,795. T'75,550,'85,565,'97,707. Syn. of Kingsessing.									
L'Epergne. Pr145. K'41,146 Cole159. MagofH'54,469. Syn. of Harvard									
Lee Seckel. L. Syn. Lee's Seckel		obo	ml	ru	b	p	vg	me	
Lee's Seckel. T'75,550,'85,565,'97,707. Syn. of Lee Seckel									
Lee's Seedling. MagofH'47,488. E'54,375,'59,395. F273. D'69,799. Syn. of Lee.									
Lefevre. D'69,799. Syns. Beurre Beaumont, Beurre de Mortefontaine, Beurre le Fevre.	Fr.	rov	vl	gb	gmj	vp		m	An old French variety; originated about 1740.
Lefevre. D'69,693. Syn. of Le Fevre (Beurre).									
Le Fevre (Beurre). L. Syns. Beurre de Mortefontaine, Beurre Le Fevre, Lefevre.	Fr.	robo	l	gyb	g			m	Possibly identical with Lefevre.
Leger. FGAofO'83,72									Not described.
Leggett. L. Syn. Leggett's									Classed with outcasts by Kenrick.
Leggett's. K'41,430. Syn. of Leggett									
Lehon Grinon. AndN'95. Syn. of Grinon									
Leim. L. Syn. Felix de Leim	Belg.	robop	m	ygru	jm	sp	g	m	Downing said that this is but little known.
L'Incommunicable. Pr203. K'32,178. Syn. of Incommunicable									
L'Inconnue. D'69,787. Syn. of Inconnue									
L'Inconstant. MagofH'57,301. D'69,788. Syn. of Inconstant									
L'Innominee. Pr213. Syn. of Innominee.									
Leipsic. IllH'96,187,204,215									In the trial orchards of Illinois experiment stations.
Leipsic Radish. EFABC'00. CanExFR'02,379		obtp	s	gyru	jg	s	g	me	In the experimental orchard at Agassiz, B. C.
Le Lectier. AofH'92,277. EFABC'00. CanExFR'05,430		oblp	s	yru		s		m	Not valuable.
Lelieur. L. Syns. Auguste Lelieur, Augustine Lelieur	Belg.?	oblp	ms	grru	bjm	s	g	m	Received from Belgium, but origin unknown.
Lelieur (Comte). L. Syns. Comte Lelieur, Frederick Lelieur	Belg.	p	l	ygbr	comj	s	g-vg	me	
Lemon. Gb. IaB3. IndH'86,82. FGAofO'91,14. MinnH'93,226. IaH'94,170. Syn. Limonaya.	Rus								Introduced from Russia in 1879.
Lemon (Mass.). MassH'66,43.	Mass								Originated by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1862.
Lemonay. EFABC'00. CanExFR'05,430		ap	m	gy	j	s	g	me	In the experimental orchard at Agassiz, B. C.
Lemon Kharkoff. EFABC'00. Syn. of Kharkoff									
Lenawee. A'56,106,'62,124. AgR'56,380. D'57,519,'69,800. F273. E'59,395	Mich.?	oblp	m	yeru	bj	p	g	me	Disseminated by Dr. Underwood Adrian, Mich.
Lench. L. Syn. Rousse Lench		obl	l	yru	bj	s		vl	Described by Hogg in the Fruit Manual.
Lent. L. Syns. Easter Saint Germain, Lent Saint Germain, Naples, Poire de Naples.		obo	l	g	j		vg		Described by Lindley.

Lentier. L. Syns. Docteur Lentier, Doctor Lenthier, Doctor Lentier	Belg.	obop	m	gyeru	jm	s	g	m	Originated about 1847. Named for M. Lentier.
Lent Saint Germain. Pr208. K'32,147,'41,125. D'69,800. Syn. of Lent									
Lent St. Germain. E'54,334,'59,346. D'57,537,'69,835. Syn. of Pound									
Lent St. Germain. GenF'33,197. D'45,448. Syn. of Tonneau									
Lenzen. R. Syn. Beurre Lenzen									In the experimental orchard at Agassiz, B. C.
Leochine. L. Syn. Leochine de Printemps	For.	obop	m	yru	b		g	vl	
Leochine de Printemps. MagofH'54,236,'57,261. D'69,800. Syn. of Leochine									
L'Oken d'Hiver. K'32,195,'41,163. Syn. of Oken									
Leonard. R. Syn. Daniel Leonard	R. I.?	ap	m				g		Exhibited by D. Leonard, of East Providence, R. I.
Leon Gregoire. MagofH'59,155,261. D'69,800. MHSC'82,60. FGAofO'83,223. EFABC'00.	Fr.?	oblp	l	gyrb	mb	sv		l	Described in Annals of Pomology.
Leonine Pinchart. MassH'62,32. D'69,800. Syn. of Pinchart									
Leon le Clerc. D'45,440. E'54,396,'59,422. F281. Hort'63,253. Syn. of Laval									
Leon le Clerc. MagofH'30,47. K'41,170. MassH'51,189. D'57,518,575. F281. Hort'63,210. T'75,550,'85,565,'97,707. Syn. of Le Clerc (Leon).									
Leon le Clerc de Laval. E'54,396,'59,422. Hort'63,253. IllH'69,136. Syn. of Laval									
Leon Leclerc Epineux. F281. Syn. of Leclerc (Leon)									
Leon le Clerc Laval. D'45,440,'57,575,'69,800. E'54,280. F281. Hort'61,316. Syn. of Laval.									
Leon le Clerc Louvain. D'69,801. Syn. of Louvain (Leon)									
Leon Rey. D'69,801. AJofHVIII,228. MassH'71,39. Syn. of Rey									
Leopold I. D'57,518,'69,801. E'59,395. Syn. Leopold First	Belg.	obtp	m	yru	jm	s	g-vg	l	Downing did not consider it valuable.
Leopold First. MagofH'51,236,'57,157,502. F281. T'75,550,'85,565,'97,707. Syn. of Leopold I.									
Leopold Premier. MagofH'55,188. Syn. of Premier									
Leopold Riche. D'69,801. Syn. of Riche									
L'Orange d'Hyver. C196. K'32,146. Syn. of Winter Orange									
L'Orient. L. Syn. Belle de L'Orient	Fr.?	oblp	ml	gyru	d		p	m	Showy, but of poor quality.
L'Orpheline. D'45,423,'57,462,'69,680. E'51,314,'59,326. F230,277. AgR'65,188. Syn. of Aremberg.									
L'Orpoline. GenF'33,196. HovI,1. Syn. of Aremberg									
Lepine. D'69,801. Syns. De Lepine, Delepine, Poire de Lepine		obl	s	yeru	cogjm	v	g	ml	A moderate grower, but very productive.
Leroux. R. Syn. Souvenir de Leroux Durand									In the experimental orchard at Agassiz, B. C.
Leroy. L. AHM253. Syn. Madame Andre Leroy	Fr.	oblp	lm	wyr	cojm	va	g-vg	m	Raised by Andre Leroy, of Angers, France.
Leschasserie. Pr.124. Syn. of Echasserie									
Leseble. L. Syns. Bergamotte Leseble, Bergamotte Leseflle	Fr.	ob	m	yru	jbm	s	g	m	Probably not desirable.
Leslie. FGAofO'93,146									Not described.
Lesmire. R. Syn. Beurre de Lesmire									Not described.
Lesueur. EFABC'00. Syn. Constants Lesueur									In the experimental orchard at Agassiz, B. C.
Leurs. F281	For.								Not described by Field.
Levard. CalB147									Published in California Experiment Station Bulletin No. 147.
Levavasseur. R. Syn. Doyenne Madame Th. Levavasseur									In the experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Le Virgoule. Pr87. D'69,877. Syn. of Virgouleuse									
Lewelling. R. Syn. Lewelling Seckel									In Benjamin Buckman's collection, Farmingdale, Ill.
Lewelling Seckel. BBL. Syn. of Lewelling									
Lewis. Pr140. K'32,195,'41,162. MagofH'38,394,'44,291,'54,559,'60,223. M'38,93,'44,80,'47,'79. D'45,441,'57,519,'69,801. Cole171. E'54,375,'59,342. AgR'50,95. F271. T'75,293,'85,311,'97,484. Syn. Roxbury St. Germain.	Mass	obo	sm	g	cojm	p	g	l	First shown at meeting of Massachusetts Horticultural Society, November, 1829.
Lewis (erroneously of the French). D'69,737. Syn. of Dix									
Lexington. TVM'96,'99,'00,'02,'04. IllH'96,187,204,'03,273,'04,223. IaH'99,86,'00,88. BBL. AHM253.	Ky		l				g	e	Found in a vacant lot by C. S. Bell, at Lexington, Ky.
Lezin. L. Syns. Monsieur le Cure, St. Lezain, Saint Lezin		p	vl	gyru	cj	s		m	Described by Hogg in the Fruit Manual.
Liart. F281. D'69,819. Syn. of Napoleon									
Libbitent. R. Syn. Bergamot Libbitent Verte									Published in Magazine of Horticulture, 1852, p. 474.
Liberale. AgR'53,282. MagofH'55,519. D'57,519,'69,801. F281. E'59,395. CGen-XXV,94. T'75,550,'85,565,'97,707.	Belg	obtp	m	gybru	jm	sp	vg	m	
Liboutton. L. Syn. Besi Liboutton	For								Not described by Field.
Liebart. D'69,802. Syns. Beurre Liebart, Chamoisine	For	oblp	l	yrru	cobr	p		me	
Liegel. R. Syns. Liegel's Winterbirne, Liegel's Winter Butter, Supreme Coloma	Ger.?		l	gy	b	p	g	l	Recommended by the German Pomological Society.
Liegel's Winterbirne. MHSC'82,59. FGAofO'83,223. Syn. of Liegel									
Liegel's Winter Butter. FGAofO'92,111. Syn. of Liegel									
Lieutenant Poidevin. Hort'57,516. F281. D'69,802. Syn. of Poitevin									
Lieutenant Poitevin. MagofH'57,301. D'57,519,'69,802. E'59,396. A'60,158. MassH'62,32. T'75,550,'85,565,'97,707. Syn. of Poitevin.									
Lifland. R. Syns. Bere Blanche de Lifland, Bere Verte de Lifland									Fruit fine, but tree tender in Canada.
Lillie. R. Syn. Inconnue Lillie									Published in Magazine of Horticulture, 1843, p. 131.
Limbertwig. IaB3. IaH'85,321. TexB16. NebH'90,130. MeP'99,62,63. Syn. of Thintwig.									
Limon. MagofH'42,57. D'45,340,'57,520,'69,802. A'54,34,'62,70. AgR'54,293. E'54,377,'59,396. F281. Hort'58,121. CGenXII,254. T'75,255,'85,273,'97,454. Syns. Bergamotte Louise, Beurre Haggerston, Haggerston, No. 8 of Van Mons, No. 10 Van Mons.	Belg	obo	sm	yr	bmj	sp	vg	me	Originated by Dr. John Van Mons.
Limonaya. Gb. Syn. of Lemon									
Lincoln. MassH'45,88. MagofH'50,296. A'54,239	Mass. ?								Exhibited by Robert Manning at meeting of Massachusetts Horticultural Society, 1845, p. 88.
Lincoln (Ill.). IllH'89,42,'90,117,'92,162,'94,196,257,353,'95,55,328. AofH'89,151. A'91,124,159. OH'91,48. C(O)HS'91,20. P'95,37. MichH'94,141. IaH'96,155. AHM253. SBros. BBL.	Ill		l					m	Origin Logan County, Ill., with Mrs. Marie Fleming.

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Lincoln Coreless. C(O)HS'91,147. AofH'92,185. IllH'94,137,'96,52,178. NJH'93,78. T'97,707. JSK'98,'01. RNY'05,256.	Tenn								Introduced in 1892 by William Parry and J. S. Collins & Son.
Linden d'Automne. GenF'33,197. D'45,437'57,503,'69,773. HovI,5. E'54,325,'59,339. F280. AgR'62,185. T'97,707. Syn. of Glout Morceau.									
Lindsay. McP'91,114. Syn. of Idaho									
Lints. R. Syn. Capiaumont Lints									Published in Magazine of Horticulture, 1855, p. 146.
Little Bastard Musk. Pr.129. Syn. of Little Muscat									
Little Blanket. Pr.17. K'41,118. D'69,802. Syn. of Little Blanquet									
Little Blanquet. Pr17. K'32,128. D'69,802. Syns. Blanche Fleur, Blanquet le Petit, Blanquet Petit, Blanquette, Circe, Little Blanket, Musk Blanquet or Blanquette, Pearl Pear, Petit Blanquet, Petite Blanquette, Poire a la Perle, Small Blanquet, White Pear.		p	s	yw	br		g	me	
Little Gem. MichB31. NYC'90. IllH'92,173									From Vermont; not described.
Little Lard. Pr106. Syn. of Merveille									
Little Muscat. Pr10. D'45,340,'57,577,'69,802. E'54,397,'59,422. H172. F281. T'75,550,'85,565,'97,707. Syns. Chiot, Little Musk, Little Bastard Musk, Muscat Petit, Muscat Robert, Petit Muscat, Petit Musk, Primitive, Sept-en-gueule, Supreme.	Fr	t	vs	yr	br	sp	g	ve	One of the very earliest of all pears.
Little Musk. GarCal587. C177. Pr10. K'32,129,'41,117. D'45,340,'57,577,'69,802. E'54,397,'59,422. F281. T'75,550,'85,565,'97,707. Syn. of Little Muscat.									
Little Swan's Egg. D'45,399. E'54,397,'59,423. Syn. of Swan Egg									
Livingston. L. Syn. Livingston Virgalieu	N.Y. ?	robo	m	gyru	jm	s	g	me	Grown along the Hudson River, but origin uncertain.
Livingston Virgalieu. D'69,803. Syn. of Livingston									
Livonie. R. Syn. Beurre blanc de Livonie	Rus. ?								Seedling of White Doyenne; hardy and promising.
Livre. K'41,124. Syn. Poire d'Une Livre									A kitchen pear; not described.
Livre de Burgoyne. D'69,772. Syn. of Gilogil									
Locke. D'45,442,'57,577,'69,803. MagofH'49,342. A'54,239. E'54,376,'59,396. H172. F273. Hort'55,193. Syns. Locke's Beurre, Locke's New Beurre.	Mass.	robo	m	ygru	mj	spv	g	l	Originated by James Locke, West Cambridge, Mass.
Locke's Beurre. MagofH'49,342. T'75,550,'85,565,'97,707. Syn. of Locke									
Locke's New Beurre. MagofH'37,52. D'45,442,'57,577,'69,803. E'54,376,'59,396. Syn. of Locke.									
Lodge. K'32,178,'41,148. D'45,398,'57,552,'69,803. MassH'47,90. B'51,307. Wg71. E'54,376,'59,343. AgR'56,330. Cult'56,339. A'62,70,'99,15. Hort'62,486. H173. F271. T'75,264,'85,282,'97,461. MichH'77,322. Syns. Bordenave, Bordenieve, Smith's Bordenave.	Pa	p	m	gbru	gjm	a	vg	m	Originated near Philadelphia, Pa.
Logan. IllH'96,187	Ill.?								In trial orchards of Illinois experiment stations.
Loijart. R. Syn. Gros Loijart									Published by Magazine of Horticulture, 1843, p. 126.
Loisel. L. Syn. Beurre Loisel	For								Published by Field, p. 278; not described.
London. L. Syn. London Sugar	Eng	p	s	yb	dm	s	g	ve	Described by Lindley.
London Sugar. Pr193. K'32,156. GenF'37,277. D'69,803. Syn. of London									
Long. R. Syns. Krasovka, Langbirne, Long Pear, Pana, Vermillion Estrangullon.				yb	j	s		me	
Long de Moukouty. MagofH'53,541. CGenIII,11. Syn. Angleterre									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Long Green. C193. Pr56. M'38,76,'44,62,47,67. D'45,418,'57,556,'69,803. Cole159. NAPC'49,11. K'32,138. B'51,307. Wg72. F281. E'54,331,'59,341. AgR'56,367. T'75,264,'85,282,'97,461. Syns. Autumn Mouthwater, Great Mouthwater, Green Mouthwater, Gros Mouille Bouche, Long Green Mouthwater, Longue Verte, Long Vert (of Coxe), Mouille Bouche, Mouille Bouche d'Automne, Mouthwater, Muscat Fleure, New Autumn, Verte Longue, Verte Longue d'Automne, Verte Longue de la Mayenne.	Eur.	obop	s	g	mj	sv	g	me	An old variety described by Duhamel.
Long Green. H172,199. Syn. of Long Green (Aut.)									
Long Green (Aut.). L. Syns. Autumn Mouthwater, Coule Soif d'Automne, Long Green, Long Green of Autumn, Mouille Bouche d'Automne, Panachee, Verte Longue d'Automne.		oblp	m	gru	bjm		g	m	A very old variety; probably obsolete.
Long Green (Esp.). L. Syns. Long Green of Esperin, Verte Longue of Esperin.	Belg.	oblp	m	gyeru	jm	v	g	me	Downing received it from L. E. Berckmans.
Long Green Mouthwater. K'41,125. Syn. of Long Green									
Long Green of Autumn. MagofH'49,448. AgR'50,95. D'69,804. T'75,264,'85,282,'97,462. Syn. of Long Green (Aut.)									
Long Green of Esperin. D'69,804. Syn. of Long Green (Esp.)									
Long Green (Pan.). L. Syns. Culotte de Suisse, Long Green Panache, Striped Dean, Striped Long Green, Suisse, Verte Longue panache, Verte Longue panachee or Suisse, Verte Longue Striped or Suisse, Verte Longue Suisse.		oblp	m	gys	jm	v	g	me	Differs from Long Green in being striped.
Long Green Panache. D'69,804. Syn. of Long Green (Pan.)									
Long Green Summer Pear. DomEncIV,182. Syn. of Prince Table									
Long Green Swiss. Cult'47,340. Syn. of Long Swiss									
Long Green Winter. DomEncIV,185. GarCal587		ap	l	g		s	g	l	Described by Dr. Mease in the Domestic Encyclopædia in 1804.
Long Island Summer. D'69,758. Syn. of Jargonelle (Eng.)									
Longland. Pr210. GenF'37,278. CGenX,239. EFABC'00		ovate		yru					Grown for the manufacture of perry.
Long Pear. FGAofO'92,108. Syn. of Long									
Long Pear. FGAofO'91,12. Syn. of Panna. [This and Long may be identical.]									
Long Rosewater. Pr147. Syn. of Rosewater									
Long-Stalk blanquet. Pr16. Syn. of Blanquet (Long Stem)									
Long-Stalked Blanket. Pr16. D'69,804. Syn. of Blanquet (Long Stem)									
Long-Stalked Blanquet. Pr16. K'32,129,'41,118. D'69,804. Syn. of Blanquet (Long Stem).									
Long-Stalked Muscat of Autumn. Pr12,129. Syn. of Muscat Fleuri									
Long-Stalked Muscat of the End of Autumn. Pr90. Syn of Rousseline									
Long-Stem. Gb. FGAofO'93,146. TexB16. Syn. Dolgokvostka Morosovskaya.	Rus.								Introduced from Russia in 1879.
Long Swiss. R. Syn. Long Green Swiss									Not described by the Cultivator, 1847, p. 340.
Long-Tailed Blanquette. Pr16. D'69,804. Syn. of Blanquet (Long Stem)									
Long-Tailed Muscat. K'32,140. Syn. of Rousseline									
Longue de Bosquet. A'71,55	For.	ap	m	yrb	mj	gy	vg	me	First fruited in America in 1870.

Longue de Moukowty. MassH'53,21. MagofH'55,274. E'59,364. Syn. of Angleterre									
Longue de Nakourts. MagofH'55.274. E'59,364. Syn. of Angleterre									
Longue de Narkouts. D'57,466,'69,661. F277. Syn. of Angleterre									
Longue du Bosquet. A Hort A'71,63. Dap 151. Syn. of Bosquet (Long)									
Longueville. Gen F'33,197. Cult'39,66. Syn. of Hampden									
Longueville d' Ecosse. D'69,778. Syn. of Hampden									
Long Verte of Core. F281. Syn. of Long Green									
Longworth. Neb.H'90 129. OH'87,95. AgR'92,261. IllH'92,172. IaH'92,27,'93, 198,'96 155. MoH'93,224. A'95,73. MichB117. WisH'03,172. BBL. AHM254. Syn. Longworth's No. 1.	Iowa								Origin with William Longworth at Dubuque, Iowa.
Longworth's No. 1. NYC'90. IllH'93,76. IaH'94,169'99,86. AJC'02. Syn. of Longworth.									
Lord Cheeney's. Pr73. D'45,430,'69,784. E'54,389. F277. Syn. of Hollande									
Lord Cheney. D'57,564,'69,784 E'59,417. Syn. of Hollande									
Lord Cornwallis. FGAofO'71,26. Syn. of Cornwallis									
Lord Martin Pear. Pr63. D'69,844. Syn. of Ronville									
Lord of Summer. Pr194. Syn. of Seigneur d'Ete									
Loriol de Barney. AgofHVIII,229. AHortA'71,67. OH'71,48. A'71,55. MassH '72,92. EFABC'00. Syn. of Barny									
Loriol de Barny. Dap128. WnI,342. Syn. of Barny									
Lormier. R. Syn. Mad. Antoine Lormier									Published by the Horticultural Art Journal, 1888, p.74; not described.
Lorraine. R. Syn. Triomphe de Lorraine									In the experimental orchard at Agassiz, B. C.
Lothrop. MassH'66,46	Mass								Originated by Dr. S. A. Shurtleff; fruited in 1866.
Lothrop's No. 1. Mass.H'80,236. A'81,66,'83,92,'85,17. MichH'85,267. [May be distinct from Lothrop]									
Lott's Bergamot. K'41,130. Syn. of Bergamot (Lott)									
Lott's Pear. D'69,779. Syn. of Harrison									
Louis Bosc. D'57,483. Syn. of Lamy									
Louis Bosc. D'57,474,'69,701. F274. E'59,366. Syn. of Montigny									
Louis Bosc. F279. Syn. of Navez									
Louis Clapp. FGAofO'83,72. Syn. Louise Clapp	For								Vigorous and hardy; not described.
Louise Clapp. FGAofO'93,146. Syn. of Louis Clapp									
Louis de Bologne. Cult'47,340. Syn. Louis of Bologna									Not described.
Louis Dupont. D'57,520,'69,871. MagofH'57,301. F280. E'59,396. T'75,550,'85,566, '97,707. Syn. of Urbaniste									
Louise. Bul6,8. Syns. Bergamotte d'Averanches, Beurre d'Avandore, Beurre d'Avranches, Beurre or Bonne Louise Aurandore, Beurre ou Bonne Louise Auradore, Bonne d'Avranches, Bonne de Longueval, Bonne Louise d'Avandore Bonne Louise d'Avranches, Centennial of Ohio, De Jersey, De Louise, Louise Bonne, Louise Bonne d'Avranches, Louise Bonne de Jersey, Louise Bonne (de Jersey), Louise Bonne of Jersey, Louise d'Avranches, Louise (Jersey), Poire de Jersey, William, William the Fourth.	Fr	oblp	l	gbr	jm	v	g-vg	m	Origin near Avranches, France. Brought to America in 1820. One of the most valuable varieties, especially when grown as a dwarf.
Louise Bonne. Pr97. K'32,146,'41,122. Cult'39,66. D'45,441,'57,587,'69,804. A'54, 239. E'54,397,'59,422. F281. T'75,550,'85,566,'97,462. S90. MichH'88,120. Syns. Avanche, Bonne Louise, Good Louis, Good Louise, Louise Bonne Real, St. Germain Blanc.	Fr	pr	l	g	com	s	g	l	
Louise Bonne. F152. Syn. of Louise									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Louise Bonne d'Avranches. K'41,148. D'45,397,'57,520,'69,805. HovI,39. E'54,330,'59,345. F218. AgR'62,185. T'75,550,'85,566,'97,707. MoH'87,96. **Syn.** of Louise.									
Louise Bonne de Boulogne. HovI,9. E'54,343,'59,413. Syn. of Le Clerc (Van Mons).									
Louise Bonne d'Hiver. D'69,835. Syn. of Pound									
Louise Bonne de Jersey. M'38,83,'44,71,'47,73. K'41,148. D'45,397,'57,520,'69,805. HovI,39. Cole162. Wg72. E'54,330,'59,345. AgR'54,251,'62,185. B'51,306,'83,372. A'62,70. AHortA'68,80. AHM253. Syn. of Louise.									
Louise Bonne (de Jersey). Bl228,237. Syn. of Louise									
Louise Bonne de Printemps. D'69 804. AJofHIX,377. Syn. of Louise Printemps.									
Louise Bonne of Jersey. GenF'33,197. D'45,397,'57,520,'69,805. AgR'50,94. HovI,39. E'54,330. H172. F218. Fi52. T'75,264,'85,282,'97,707. WnI,326,II,336,III,258. AofH'90,202. Syn. of Louise									
Louise Bonne Real. MagofH'40,391,'55,146. D'45,441,'57,577,'69,804. E'54,397,'59,422. F281. Syn. of Louise Bonne.									
Louise Bonne Saunier EFABC'00. CanExFR'05,431. Syn. of Saunier									
Louise d'Avranches. EFABC'00. Syn. of Louise									
Louise de Boulogne. B'51,317			l		br			vl	Cultivated by Ellwanger & Barry in the early fifties.
Louise de Carcelles. F'281. Syn. of Carcelles									
Louise d'Orleans. Hort'46,140. MagofH'47,450. AgR'53,282	Belg								Originated by Dr. John Van Mons. Distinct from Urbaniste.
Louise d'Orleans. MagofH'47,450,'53,105. B'51,317. HovII,21. E'54,342. A'62,188. D'69,871. T'75,550. Syn. of Urbaniste.									
Louise de Prusse. MassH'51,189,'53,19. MagofH'52,39. Hort'54,78. AgR'54,243,'63,126. D'57,545,'69,859. F281. E'59,351. Syn. of Stevens.									
Louise Morel. MagofH'42,250. Syn. of Morrel									
Louise Morrel. K'41,170. Syn .of Morrel									
Louise Nova. L. Syns. Marie Louise Nova, Marie Louise the New	Belg	ap	m	ybr	mj		g	me	Sent to Robert Manning by Dr. John Van Mons.
Louise of Boulogne. A'54,239. D'69,806. Syn. of Boulogne									
Louise of Orleans. E'54,342,'59,352. Syn. of Urbaniste									
Louise Printemps. L. Syn. Louise Bonne de Printemps	Fr	oblp	l	yrru	mlj	sp		vl	Raised by M. Boisbunel, of Rouen, France.
Louise Vilmorin. EFABC'00									In the experimental orchard at Agassiz, B. C.
Louis Gregoire. D'69,806	Fr	robop	m	gyru	jm	sv	g	m	Raised in 1832 by M. Gregoire, of Jodoigne, Belgium.
Louis of Bologne. MassH'44,60. Syn. of Boulogne									
Louison. Pr86		obl		yr	m	v		m	A very old variety.
Louis Philippe. K'41,169. H173. F280. Syn. of Salomon									

Louis Vilmorin. AJofHVIII,228. Dap128. FGAofO'73,782. WnI,333,II,342. CanExFR'95,391,'00,462. Syn. of Vilmorin.									
Lourmel. L. Syn. General de Lourmel	Fr.	r	sm	ybru	jm	s	g	m	
Louvain. L. Syns. Beurre de Louvain, Bezi de Louvain, Bezy de Louvain, De Louvain, Gros Quere, Parabelle Musque, Poire de Louvain, Poire Louvain, Rateau Gris, Valandree.	Belg.	obop	m	yrru	bm		g	m	Originated by Dr. John Van Mons in 1827, at Louvain.
Louvain (Leon). L. Syn. Leon le Clerc Louvain	Belg.	p	l	gyru	jbm	s		m	Originated by Dr. John Van Mons, at Louvain.
Louvain (Triomphe). L. Syns. Triomphe de Louvain, Triomphe de Souvain	Belg.	rob	m	gyru	co	s	g	me	
Louvenjal. L. Syns. Delices de Louvenjal, DeLouvoyan, Jules Bivort	Belg.?	obtp	ml	gyru	jm	sv	g vg	m	
Lovaux. HAJ'88,74. OH'71,48			lm		jm	s	g		Not desirable; rots at the core.
Love Pear. Pr117. D'69,659. Syn. of Amour									
Love Pear. K'32,161,'41,128. Syn. of Catillac									
Low Countries. L. Syns. Queen of Netherlands, Queen of the Low Countries, Reine des Pays Bas.	Belg.	ap	l-vl	yrru	bmj	sav	vp	m	Originated by Dr. John Van Mons.
Lowell. K'32,196,'41,130. Syn. Lowell's	Eng.								Not described.
Lowell's. MagofH,'43,131. Syn. of Lowell									
Lowell's Bergamotte. K'32,139,'41,127. Syn. of Sugar Top									
Lowry's Bergamot. MagofH'37,14. A'79,84. Syn. of Sugar Top									
Lucas. L. Syn. Gros Lucas	For.								Published by Field, p. 280; not described.
Lucie Andusson. Dap151. Syn. of Andusson									
Lucie Andusson. AJofHVIII,229. MassH'71,41. Hort'75,2. Syn. of Andusson.									
Lucie Grieve. FGAofO'83,72	Eur.								Tree hardy and vigorous.
Lucien Chaure. EFABC'00									In the experimental orchard at Agassiz, B. C.
Lucien Leclercq. F281. D'69,806. Syn. of Leclercq (Lucien)									
Lucius. R. Syns. Dr. Lucien, Dr. Lucius		obtp	l	gyru	jm		p	m	Mentioned by L. Weltz in Transactions Ohio Horticultural Society, 1887, p. 95.
Lucra. MassH'66,46.	Mass.								Much like Merriam. Originated at Brookline, Mass.
Lucrate. D'69,762. Syn. of Lucrative									
Lucrative. Bul6,8. Syns. Arbre Superbe, Autumn Melting, Belle Lucrative, Bergamotte Fievee, Bergamotte Luc, Bergamotte Lucrative, Beurre Luc, Beurre Lucrative, Du Seigneur, Esperin's Herrenbirne, Fondante d'Automne, Fondante de Mauberge, Gresillier, Groseilliere, Lucrate, Seigneur, Seigneur d'Esperin.	Fl.	obtp	m	ygru	jm	s	vg b	me	One of the very best early autumn pears.
Lucy Duke. A'85,153,'97,32. WNYH'89,65. IllH'96,209. T'97,707. AlaB30. BBL. EFABC'00.	N. C.								Origin Beaufort, N. C. Perhaps same as Duke.
Lucy Duke. GarM'86,365. A'87,90. JVL'93,'99,'00,'02. E&B'94,'02. CanExFR'00,462. Syn. of Duke.									
Lucy Grieve. Dap151. Syn. of Grieve									
Luizet. L. EFABC'00. CanExFR'01,546. Syn. Beurre Luzet	Fr.	oblp	ml	gyr	djm	sv		m	Originated with M. Luizet in 1847.
Luke. R. Syn. St. Luke									In the experimental orchard at Agassiz, B. C.
Lutovka. Gb. MeP'99,62,63	Rus.		l				g	m	Introduced from Russia in 1882.
Lutschaninov. FGAofO'91,12	Rus.?								Not described.
Lycurgus. Hort'57,365. E'59,396. A'62,113. AgR'62,191. OH'64,13. D'69,806. T'75,289,'85,307,'97,480.	Ohio	oblp	s	gybru	jm	sp	vg	l	Originated with George Hoadly, of Cleveland, Ohio.
Lydia Thierard. AJofHVI,51,99. D'69,806. AHortA'70,77. Syn. of Thierard									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Lyerle. A'97,44. Syn. Lyerlie	Ill.?								Said to have originated from seed of Bartlett.
Lyerlie. M&S'01. AJC'02. Syn. of Lyerle									
Lyon. D'69,807. T'75,278,'85,296,'97,472	R. I.	obl	m	yeru	cogjm	s	g-vg	m	Originated at Newport, R. I.
Mabille. MagofH'36,456,'37,37,53. K'41,133. MassH'44,61. A'54,239	Eur.		l	y	b		vg	l	Imported from France by Judge Buel, of Albany, N. Y.
Mabille. MagofH'46,176. D'57,424,'69,686. F277. T'75,550,'85,556,'97,708. Syn. of Diel.									
Mabille. F281. D'69,819 Syn. of Napoleon									
McBean. F273	N. Y.	obop	l	yru			g	m	Probably should be "McVean." See Downing, 1869, p. 807.
Mace. MassH'60,50,'72,91,'73,98. WNYH'05,140	Mass.								One of Francis Dana's named seedlings.
McGill Seedling No. 1. FGAofO'82,81. [Originated at Oshawa, Canada]									
McGill Seedling No. 2. FGAofO'82,81. [Originated at Oshawa, Canada]									
McGill Seedling No. 3. FGAofO'82,81. [Originated at Oshawa, Canada]									
Macklim's Seedling. CanH'87,282. [Said to have originated at Markham, Ontario, Canada.]									
McLaughlin. MagofH'42,62,'44,37,213,'47,251. MassH'43,4,47. Cole170. B'51,318. Wg'72. A'52,62. AgR'53,280,'63,125. E'54,377,'59,397. D'57,524,'69,807. F272. T'75,289,'85,307,'97,480. Bul6,8. AHM255.	Me.	obtp	l	gyru	jm	sp	g-vg	l	Introduced by S. L. Goodale, of Saco, Me.
McLellan. A'62,151. AgR'63,127. D'69,880. Syn. of Whieldon									
Macomber. IllH'92,173. MichB31. P'95,38. BBL. Syn. Macumber	Vt.?	p	m	gyb	bmj	s	vg-b	me	In the collection of Benjamin Buckman, Farmingdale, Ill.
Macomber No. 6. MichB31. [Not described]									
Macumber. IndH'86,82. Syn. of Macomber									
McVean. Hort54,340. D'57,578',69,807. T'75,551,'85,566,'97,709	N. Y.	obop	l	yru	co	s	g	me	Originated in Monroe County, New York.
Madame. D'68,883. Syn. of Windsor									
Madame Adelaide Reves. D'57,449,69,654. Syn. of Adelaide									
Madame Adelaide Reves. MagofH'57,302. Syn, of Reves									
Madame Andre Leroy. A'75,56. OH'71,48. Dap129. MichH'75,285. E&B'94. AHM253. Syn. of Leroy.									
Mad. Antoine Lormier. HAJ'88,74. Syn. of Lormier									
Madame Appert. AJofHVIII,229. Dap151. NYC'90	Fr.	rp	ml	g	djm	sp		m	Raised by A. Leroy and named for his daughter.
Madame Baltet. EFABC'00									In the experimental orchard at Agassiz, B. C.
Madame Baptiste Desports. A'71,55. OH'71,48. Dap152. Hort'72,102. Syn. of Desportes (Madame).									
Madame Bonnefond. EFABC'00. CanExFR'05,431. Syn. of Bonnefond									
Madame Chaudy. EFABC'00. Syn. of Chaudy									
Madame Cuissard. AJofHVIII,228. MassH'72,92. Dap129. Syn. of Cuissard									

Madame de France. D'69,883. Syn. of Windsor									
Madame Delmotte. AJofHVIII,228. MassH'71,39		obtp	m	g					Fruited with Robert Manning.
Madame Desportes. Hort'74,148. Syn. of Desportes (Madame)									
Madame Ducar. D'57,522,'69,808. E'59,397. T'75,550,'85,566,'97,708. Syn. of Ducar.									
Madame du Puis. EFABC'00									In the experimental orchard at Agassiz, B. C.
Madame Durieux. D'69,808. Syn. of Durieux									
Madame Elisa. MassH'53,21. MagofH'54,86. FGAofO'72,14. Syn. of Madame Eliza.									
Madame Eliza. D'57,522,'69,809. MassH'58,74. AgR'58,396. E'59,396. F281. Hort'61,315,'72,38. B'83,382. Syn. Madame Elisa.	Belg	oblp	l	yru	gjm	sp	vg	m	Named in honor of Mrs. L. E. Berckmans.
Madame Favre. AJofHVIII,229. MassH'71,41. Dap129. AgR'75,381. EFABC'00. CanExFR'02,380.	Fr	robt	l	gyru	dmj	s		m	Discovered by M. Favre, of Chalons, France.
Madame Flou Aine. EFABC'00. Syn. of Flou Aine									
Madame Gregoire. D'69,809. EFABC'00	Belg	oblp	l	gybru	m	svp		m	Raised by M. Gregoire, of Jodoigne, Belgium.
Madame Hemminway. E&B'94,'02. IHH,96,178. EFABC'00. CanExFR'05,430. Syn. of Hemminway.									
Madame Henri Desportes. D'69,809. MassH'71,39,'74,157. A'73,76. Hort'75,1. T'75,550,'85,566,'97,708. Syn. of Desportes.									
Madame Hutin. EFABC'00. Syn. of Hutin									
Madame Loriol. L. Syns. Madame Loriol de Barny, Mme. Loriol de Barney	Fr	oblp	m	gybru	comj	v	g-vg	m	Originated with Andre Leroy, Angers, France.
Mme. Loriol de Barney. OH'71,48. Syn. of Madame Loriol									
Madame Loriol de Barny. AJofHVIII,228. AHortA'71,69. MassH'72,92. Dap 129. Syn. of Madame Loriol.									
Madame Lye Baltet. EFABC'00									In the experimental orchard at Agassiz, B. C.
Madame Millet. D'57,521,'69,809. MagofH'57,301. E'59,363. T'75,550,'85,566,'97,708. NYC'90. E&B'94. AHM255. Syn. of Millet (Madame).									
Madame Rosseels. EFABC'00. Syn. of Rosseels									
Madame Treyve. AJofHV,53. D'69,809. AHortA'70,73. A'71,56,'81,30. T'75,550, '85,566,'97,708. MichH'75,285. E&B'94. Syn. of Treyve.									
Madame Vert. MagofH'50,296,'60,221. A'54,239. EFABC'00. CanExFR '01,546.		r	m	gyr		sv		me	In the trial orchard at Agassiz, B. C.
Mme. Von Siebold. GaH'85,47,'92,49. LaB22. PPB'01. Syn. of Siebold									
Madame Von Siebold. GaH'85,49,'93,53. A'87,95. OH'87,166,'98,8. GHM&S'90'94. NYC'90. Syn. of Siebold.									An Oriental variety; not liked by P. J. Berckmans.
Madeleine. C178. Pr13. K'32,129 '41,118. M'38,64 '44,48,'47,56. IndF'40,181. Gen'33,196,'37,277. Cult'42 166 '44 36. D'45 341,'57,441,'69,809. Cole151. Wg72. B'51,300,'83,361. AgR'50,94'53 81. E'54,331,'59,343. H143. T'75,252,'85,270,'97,453. Syns. Citron de Carmes, Citron des Carmes, Early Chaumontelle, Early Chaumontel (incorrectly), Early Madelaine, Early Rose Angle, Green Chisel (incorrectly), Grune Magdalena, Grüne Sommer, Grune Sommer Magdalena, Hasting pear, Madeleine au Citron des Carmes, Madeline, Magdalen, Magdaleine, Magdelen, Poire Hativeau or hativeau, Sainte Madelaine.	Fr?	obop	m	ygbru	jm	sp	g-vg	ve	Ripens at the feast of St. Madeleine and first cultivated by the Carmelite Monks.
Madeleine (Ang.). L. Syn. Madeleine d'Angers	For								Published by Field, p. 281.
Madeleine d'Angers. F281. Syn. of Madeleine (Ang.)									
Madeleine or Citron des Carmes. D'45,341,'57,441,'69,809. H143. Syn. of Madeleine.									
Madeleine Vert. D'69,775. Syn. of Chisel									
Madeline. Pr13. G83. F281. Bl227,230. WnIII,335. Syn. of Madeleine									
Madeliene Striped. L17. Syn. of Madeline, Var									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Madeline, Var. F281. Syns. Citron des Carmes panache, Madeliene Striped	For								Published by Field; not described.
Madmoiselle Blanche Sannier. FGAofO'83,72. Syn. of Blanche Sannier									
Madot. F276. Syn. of Amadotte									
Madotte. K'41,148. MagofH'42,166,'50,296,'52,419. MassH'44,66. A'54,239. E'54, 397,'59,423. Hort'55,193. D'57,563,'69,657. T'75,551,'85,566,'97,708. Syn. of Amadotte.									
Magdalen. Pr13. GenF'37,277. E'54,331. '59,343. AgR'63,125. T'75,252,'85,270, '97,453. AHM255. Syn. of Madeleine.									
Magdeleine. Pr13. K'32,129. Syn of Madeleine									
Magdelen. D'45,341,'69,809. E'54,331. F247,281. T'85,270. Syn. of Madeleine									
Magnate. MichSB30. MichB205. CanExFR'96,445. IllH'97,213. EFABC'00		obtp	ml	yrb	tjm	vp	vg	m	In Bulletin of the Michigan Agricultural Experiment Station, p. 56. It is said to be "very promising."
Magnolia. AgR'93,288. JVL'99,'02. IllH'99,219. Bul8. LaB81. JSK'01. HuC'01. GHM&S. JAY'00.	Ga	obr	ml	ru	m		g	e	Belongs to the Oriental class of pears.
Magnolia Snow. IllH'96,194. McP'99,63. Syn. of Snow									
Mahoning. A'83,131. OH'85,81	Ohio								Introduced from Mahoning County, Ohio.
Mai. L. Syns. Besi de Mai, Bezi Mai	Belg	obt	l	yg	bj	s		vl	Raised by M. Jonghe, of Brussels. Fruited in 1856.
Maiden of Flanders. Pr11. D'69,818. Syn. of Muscat Robert									
Maiden of Xaintonge. Pr11. D'69,818. Syn. of Muscat Robert									
Mailanderin Grosse Grune. D'69,819. Syn. of Napoleon									
Maitre. L. Syn. Fondante de la Maitre d'Ecole	Eur	p	m	y	m			l	Described by Hogg in the Fruit Manual.
Major. L. Syn. Pope's Scarlet Major	N. Y	obo	ml	yr	br		p	me	Originated on Long Island.
Malconnaitre. E'59,397. D'69,722. Syn. of Collins									
Malconnaitre d'Haspin. MassH'53,18. MagofH'54,83. D'57,522,'69,810. E'59,397. T'75,551,'85,566,'97,708. Syn. of Haspin.									
Malines. Bul6,8. Syns. Josephine de Malines, Josephine (erroneously), Josephine of Malines.	Belg	robt	m	gyru	m	sp	vg	l	Raised by Maj. Esperen, of Malines, Belgium.
Malines. T'97,708. Syn. of Winter Nelis									
Malines (Fondante). L. Syns. Fondante de Malines, Fondante de Malines (Esperen).	Belg	obop	m	yru	cojm	sp	g-vg	m	A seedling raised by Maj. Esperen.
Malines (Gift). L. Syns. Gift from Malines, Present de Malines	Fl			y	m	p	g		Raised by Count Coloma, of Malines, Belgium.
Malines (Jos.). St. Syn. of Malines									
Mammoth. AgR'55,297									This may be Ochletree.
Mammoth. MagofH'42,403. IndH'75,42,'78,87. IaH'77'66. Syn. of Ochletree									
Manchester. D'69,810. Syns. Manchester Late, Manchester October	R. I	obop	m	yeru	m	s	g	m	Originated in Providence, R. I.
Manchester Late. D'69,810. Syn. of Manchester.									
Manchester October. A'62,151. D'69,810. Syn. of Manchester									

Mandarine. L. Syn. Orange Mandarine		r	m	ybru	dm	as		m	Described by Hogg in the Fruit Manual.
Mandieu. Ph37. D'69,656. Syn. of Mon Dieu									
Mannet. Thi86. Syn. of Colmart									
Manna and Manne. Pr99. Syn. of Colmar									
Manning. MassH'66,43	Mass.								Raised by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1866.
Manning's Elizabeth. D'45,385,'57,496,'69,810. MassH'47 58. Hov1,41. AgR'56,338. AJofHVIII,159. WisH'80,81,105. B'83,364. 260. T'75,255,'85,273,'97,455. MichH'86,420. Bul 6,8. Syn. of Elizabeth.									
Manning's Elizabeth Beurre de Jelles. FGAofO'92,111. Syn. of Elizabeth									
Mannington. A'69,45 101. Dap129	N. J.	ovate	s	gybru	jm	sp	vg-b	m	Originated by J. M. Hannah, of Salem, N. J.
Mansfield. D'69,811. AHortA'69,79	Am.	rob	m	ygru	cbm	sa	g	me	
Mansuette. Pr62 K'32,129,'41,122. MagofH'43,127. D'57,577,'69,661. F281. T'75,551,'85,566,'97,708. Syn. of Angobert									
Mansuette. Pr93. Syn. of Spanish									
Mansuette Solitaire. Pr62. K'32,129. Syn. of Angobert									
Marasquine. D'69,811	Belg.	obl	m	ygru	gm	sp		me	Disseminated by Maj. Esperen.
Marceaux. MagofH'43,131									Not described.
Marcelis. MagofH'50,296. Syn. of Marulis									
Marcellis. A'54,239. E'54,397,'59,422. D'69,815. Syn. of Marulis									
Marcenay. R. Syn. De Marcenay									Published in Magazine of Horticulture, 1843, p. 131.
March Bergamot. MagofH'47,51,'50,498. A'54,239. F281. Syn. March Bergamotte.	Eng.	r		gru	co	p	p		In the rejected list of Congress of Fruit Growers, 1849.
March Bergamotte. MagofH'47,151. E'54,377,'59,398. D'57,578,'69,811. H174. T-'75,551,'85,566,'97,708. Syn. of March Bergamot.									
Marchioness. Pr80. Syn. of Marquise									
Marchionesse. K'32,138,'41,123. Syn. of Marquise									
Marechal. R. Syns. Band de la Cour, B. O. de la Cour, Conseiller de la Cour, Duc d'Orleans, Grosse Marie, Marechal de Cour, Marechal Decours, Marechal de la Cour.	Belg.	oblp	ml	gyru	bjm	v	vg	m	Originated by Dr. John Van Mons; dedicated to his son in 1845.
Marechal de Cour. MagofH'52,300,'58,280. WHRII,560. D'57,483. F281. Syn. of Marechal.									
Marechal Decours. D'69,811. Syn. of Marechal									
Marechal de la Cour. MagofH'53,25,'57,156. E'54,377,'59,400. F278. Hort'60,68. AgR'63,124. D'69,811. MichH'74,28. T'75,551,'85,566,'97,708. B'83,372. Syn. of Marechal.									
Marechal Dillen. D'57,524,'69,811. T'75,551,'85,566,'97,708. Syn. of Dillen									
Marechal Pelissier. D'57,523. F281. T'75,551,'85,556,'97,708. Syn. of Pelissier									
Marechal Pellissier. MagofH'57,302. Hort'57,516. Syn. of Pelissier									
Marechal Vaillant. Dap130. Syn. of Vaillant									
Margaret. Hort'66,172. A'67,150,'69,53. AJofHIV,49. D'69,811. HAJ'90,64. MoH'90,45,56. CanExFR'95,390. IllH'96,209.	Ohio.	obl	sm	yr	j	s	g	me	Raised by C. Wiegel, of Columbus, Ohio.
Marguerite. GaH'93,49. Bul6,8. WisH'02,114. AHM225. Syn. Petite Marguerite.	Fr.	obtp	ms	ybru	bjm	sp	vg	me	Originated by Andre Leroy, of Angers, France.
Marguerite la Grosse. MagofH'43,131									Probably distinct from Marguerite.
Marguerite Marillat. GaH'93,54,56. EFABC,00		p	l	ybr			g	ve	Exhibited by P. J. Berckmans; new and promising.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Contined.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Maria. FGAofO'71,25,'74,68. Dap152. Syn. Curran	N. S. ? Ont. ?	r	ms	yr	dbjm	sv		me	Downing says that this variety originated in Windsor, N. S.; perhaps Ontario.
Maria. HovII,37. E'54,377,'59,398. Syn. of Marie Louise									
Maria Lesueur. R. Syn. Premices de Maria Lesueur									In the experimental orchard at Agassiz, B. C.
Maria Louise. Cole164. Syn. of Marie Louise									
Maria Louise bis. Cult'47,340									Not described.
Marianne. AgR'67,139. D'69,827. Syn. of Paradise									
Marianne de Nancy. D'57,524,'69,812. F281. E'59,397. T'75,551,'85,566,'97,708. Syn. of Nancy.									
Marianne Nouvelle. D'45,358. HovI,65. E'54,315,'59,329. AgR'63,123. Syn. of Bosc.									
Maria Nouvelle. D'57,531,'69,827. F254,282. AgR'67,139. Syn. of Paradise									
Maria (Princess). L. Syns. Princess Maria, Princess Marie	Belg	obop	ms	yru	cojm	vp	g	me	Originated by Dr. John Van Mons.
Marie-Anne. R. Syn. Marie-Anne de Nancy		t	m	gru	mb	sv	g	m	This may be Nancy.
Marie-Anne de Nancy. MagofH'54.456. Syn. of Marie-Anne									
Marie Benoist. B'83,382. NYC'90. EFABC'00	Fr		l				g	l	
Marie Chretienne. GenF'33,197. K'41,148. D'45,399,'57,522,'69,813. HovII,37. E'54,377,'59,398. F248. Syn. of Marie Louise.									
Marie de Nantes. MagofH'57,302 D'69,812. Syn. of Nantes (Marie)									
Marie Guisse. D'69,813. AofH'91,296. EFABC'00. Syn. of Guisse									
Marie Louise. Pr131. K'32,179,'41,148. GenF'33,197. M'38,87,'44,75,'47,79. Cult'39,66. D'45,399,'57,522,'69,813. Hort'49,408,'71,130. HovI,37. Wg72. B'51,307,'83,382. E. '54,377,'59,398. H174. F248. T'75,265,'85,283,'97,462. Syns. Braddick's Field Marshal, Braddick's Field Standard, Corchorus, Farim Maria Louise, Forme de Marie Louise, Maria, Maria Louise, Marie Chretienne, Marie Louise d'Elcourt, Marie Louise de Jersey, Marie Louise Delacourt, Marie Louise Doukelar, Marie Louise Nouvelle, Marie Louise Nova, Marie Louise (the second), Princesse de Parme, Van Donckelaer, Van Donkelear.	Belg	oblp	ml	gym	bru	sv	vg	l	Fine in its native country, but variable in America.
Marie Louise d' Elcourt. K'41,149. D'69,813. Syn. of Marie Louise									
Marie Louise Delacourt. K'41,149. D'69,813. EFABC'00. Syn. of Marie Louise.									
Marie Louise de Jersey. D'69, 813. Syn. of Marie Louise									
Marie Louise Donkelar. D'69,813. Syn. of Marie Louise									
Marie Louise d' Uccle. MassH'62,32. D'69,813. AHortA'69,71. A'69,53. B'83,382. WnI,333,II,342. AofH'90,202. Syn. of Uccle.									
Marie Louise Nouvelle. D'69,813. Syn. of Marie Louise									
Marie Louise Nova. K'41,169. MassH'44,60. D'45,371,'57,483 A'54,236. H175. F278. E'59,373. Syn. of Lamy.									
Marie Louise Nova. D'45,400,'57,577,'69,813. MassH'46,151. E'54,397,'59,423. T-'75,551,'85,566,'97,708. Syn. of Louise Nova									
Marie Louise Nova. L17. Syn. of Marie Louise									
Marie Louise **(the new). F281. Syn. of Louise Nova**									

Marie Louise (the second). D'45,371,'57,483. E'54,360,'59,373. F278. Syn. of Lamy.								
Marie Louise (the second). L17. Syn. of Marie Louise								
Marie Parent. MagofH'54,236,458. D'57,522,'69,814. F281. E'59,397. T'75,551,'85 566,'97,708. Syns. Ferdinand de Meester, Roussellet de Meester, Sophia Beekmans, Surpasse Meurice.	Belg.	obop	m	gyru	j	v	g	me	Raised by Bivort in 1844; fruited in 1851.
Marion. D'69,815. Syn. of Messire								
Market. R. Syn. Early Market									On trial at Illinois experiment stations.
Marmion. D'69,814	Belg.	rp	s	yr	co	s	p	m	In the experimental orchard at Agassiz, B. C.
Marnix. R. Syn. Colmar de Marnix								
Marotte Sucree Jaune. GenF'33,197. K'41,164. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.								
Marquise. C208. Pr80. K'32,138,'41,123. MagofH'50,296. A'54,239. F281. Syns. Marchioness Marchionesse, The Marquis.		p	l	gyr	bmj	sp		l	
Marquis de Bedmar. K'41,170. MagofH'42,250,'54,86. Syn. of Bedmar								
Marquise de Bedmar. MassH'53,21. D'69,814. Syn. of Bedmar								
Marquis d'Hem. Dap,155. Syn. of Hampden								
Marquise Stas. MagofH'55,146									Not described.
Mars. L. T'97,708. Syns. Captif de St Helena, Comtesse de Lumay, Comtesse de Lunay, Comtess of Lunay, Duchesse of Mars, Duchesse de Mars.	Fr.	obtp	ms	ybru	mj	sv	vg	m	Described in 1850 by M. Prevost.
Marsh. MagofH'47,81									Not described.
Marshall. Dap179. HAJ'86. NJH'87,32. AofH'91,194. MichB31	N. Y.	robtp	m	yru	jm	vp	vg	me	Said to have originated with William Marshall, of Cambridge, Mass.
Marshall de la Cour. MagofH'52,419									Cultivated by Col. M. P. Wilder.
Marshall Vaillant. CanExFR'95,392. EFABC'00. Syn. of Vaillant								
Marshal Wilder. Hort'72,150,'73,37	Ind.?								Named by J. H. Haynes, of Delphi, Ind., for Col. M. P. Wilder.
Martha Ann. MagofH'50,547. D'57,522,'69,814. F274. E'59,397. T'75,551,'85,566,'97,708. Syns. Danas, No. 1, Martha Anne, Marthy Ann, Marthy Anne.	Mass.	obtp	m	ygru	coj	a	p	m	Raised by Francis Dana, of Roxbury, Mass.
Martha Anne. MagofH'53,28 Syn. of Martha Ann								
Marthy Ann. MagofH'54,136. Syn. of Martha Ann								
Martha Anne. MagofH'53,534. Syn. of Martha Ann								
Martigny. R. Syn. Belle de Martigny									Published in Magazine of Horticulture, 1842, p. 431.
Martillet. EFABC'00									In the experimental orchard at Agassiz, B. C.
Martin. KanH'86,171. IndH'03,258	Kan.?	oblp	ml	gy	bj		g	vl	Originated in Cowley County, Kans.
Martin Clavier. EFABC'00. Syn. of Clavier								
Martin Sec. C207. Pr58. K'32,147,'41,123. MagofH'37,45. MassH'44,64. A'54,239. E'54,377,'59,398. F281. D'57,577,'69,814. H174. T'75,551,'85,566,'97,708. EFABC'00. Syn. of Sec.								
Martin Sec de Champagne. D'69,814. Syn. of Sec								
Martin Sec d'Hiver. D'69,814. Syn. of Sec								
Martin Sec de Provence. MagofH'43,131. Syn. of Sec								
Martin Sire. Pr62. K'32,147,'41,124. D'69,814. Syn. of Sire								
Martin Sire (incorrectly). Pr63. D'69,844. Syn. of Ronville								
Marulis. MagofH'43,388. E'54,397,'59,422. D'69,815. Syns. Marcelis, Marcellis	For.	r	s	gy			p	me	Description from Elliott.
Marum. R. Syn. Marum Flask		oblp	l	y	j	s	g	m	In the experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Marum Flask. EFABC'00. CanExFR'04,480. Syn. of Marum									
Mary. Hort'66,78. A'67,150. D'69,815. A'69,52,100. AJofHIV,49,VIII,224. AHortA'70,77. MVHS'86,103. IHH97,213,'02,220.	Ohio	rp	sm	yrru	jb	s	vg	ve	Origin by William Case, Cleveland, Ohio.
Maryland Seedling. A'69,101. AJofHVII,79. Syn. of Sam Brown									
Mas. R. Syn. Alexandrine Mas	Fr	obtp	l	ygru	j	sp		l	Originated from seed of Passe Colmar in 1850.
Mashetchnaja dwoinaja. IaH'80,61	Rus								Mentioned by Prof. Budd among Russian varieties.
Maslitchdvoinaya. IaH'88,190. Syn. of Double Buerre									
Maslitchnaya dvoinaya. Gb. Syn. of Double Buerre									
Mas (Pres.). L. Syn. President Mas	Fr	oblp	l	gyru	djmb	s		l	From Transon's Catalogue.
Mason. MassH'48,101									This may be Hull. See Massachusetts Horticultural Report, 1848, p. 101.
Massachusetts. MassH'44,63									Exhibited by Mr. Winship at meeting of Massachusetts Horticultural Society, 1844.
Mather. Hort'51,439. A'56,82,'99,15. AgR'56,363. D'57,524,'69,815. F274. E'59,398. T'75,551,'85,566,'97,708.	Pa	rov	ms	gyr	co	s	g	me	Origin with J. Mather, Jenkinstown, Pa.
Mathews' Eliza. MagofH'58,419. Syn. of Groom									
Matilda. WisH'89,176. CanExFR'96,136. EFABC'00									Recommended by G. P. Peffer, in Wisconsin Horticultural Society Report, 1889.
Matthews. A'03,82	Ill.?								A new variety from Hopedale, Ill.
Matthews' Eliza. D'69,776. Syn. of Groom									
Maunne. F279. Syn. of Colmar									
Maurice Desportes. AHortA'70,612. AJofHVIII,229. MassH'71,40. OH'71,48. Dap130. AgR'75,381. Hort'75,5. Mich'75,89. B'83,382. Syn. of Desportes.									
Maury. L. Syn. Elizabeth Maury	Va	ob	s	gyb	djm	sv		me	Originated by R. Maury, Charlottesville, Va.
Mauxion. A'62,112. CGenXX,222. T797,708. Syn. Beurre Mauxion		rp	m	yrru	dbmj	svp	vg	me	
Max. AgR'92,262. A'95,73	Ohio								An Ohio seedling of Flemish.
Mayflower. MassH'66,44. EFABC'00	Mass								Raised by Dr. S. A. Shurtleff, of Brookline, Mass. Fruited in 1863.
Maynard. A'54,74. D'57,524,'69,815. F274. E'59,238. T'75,551,'85,566,'97,708	Pa	obop	ms	yeru	j	s	g p	ve	From Lancaster County Pa.
Meadow Feaster. D'57,567,'69,703. Syn. of Bleecker									
Meadow Pear. Pr215. MagofH'53,566. AgR'54,272. L15. Syn. of Bleecker									
Mear's Summer Butter. D'69,751. Syn. of Craig									
Mecham. A'67,195	Utah?		vl	g				m	Reported by J. E. Johnson, of St. George, Utah.
Mecheln. R. Syn. Josephine von Mecheln									Introduced in 1891. See Annals of Horticulture, 1891, p. 296.

Meconnaitre. D'69,722. Syn. of Collins									
Medaille. Pr204. K'32,179,'41,149. GenF'33,197,'37,278. D'45,401,'57,526,'69,819. E'54,378,'59,400. F249,281. Syn. of Napoleon.									
Medaille d'Or. F281. D'69,767. Syn. of Wurtemburg									
Medfield. R. Syn. Medfield Beauty	Mass.?		s					ve	Published in Massachusetts Horticultural Report, 1858, p. 74.
Medfield Beauty. MassH'58,74. MagofH'59,40. Syn. of Medfield									
Medotka. CanH'94,292. Syn. Poire Miel	Rus.?	obtp	vl	y	m		g		Described as new and little known.
Medovia. R. Syn. Medovia No. 4									In the experimental orchard at Agassiz, B. C.
Medovia No. 4. CanExFR'96,136. Syn. of Medovia									
Medvedevka. CanH'94,292. Syn. of Bear									
Medviedevka. IaH'85,323. IaB3. FGAofO'89,3. Syn. of Bear									
Medviedka. FGAofO'94,119. Syn. of Bear									
Meester. L. Syns. Colmar de Meester, Demeester	Belg.	robtp	m	yru	cojm	v	g p	m	
Melia de Waterloo. WHRIV,165. Syn. of Mella									
Mella. L. Syns. Melia de Waterloo, Mella de Waterloo			l	gy	mj		b	m	Published in Western Horticultural Review, vol. 4, p. 165.
Mella de Waterloo. H175. WHRIV,165. Syn. of Mella									
Mellish. D'69,815		rp	ms	yru	jm	s	g-vg	m	
Mello. L. Syns. Adele de St. Cerras, Adele de St. Denis, Adele St. Dennis, Baron de Mello, Baronne de Mello, Barronne de Melle, Beurre Van Mons, Poire His, Phillip Goes, St. Cerran.	Belg.	ap	m	ybru	cojm	sv	vg	m	Described by Bivort in Album of Pomology.
Melon. F281. D'69,819. Syn. of Napoleon									
Melon de Kops. K'41,148. D'45,360,'57,425,'69,689. HovI,77. E'54,313,327. F277. AgR'62,181. Syn. of Diel.									
Melon de Namur. Cult'47,340. MagofH'52,300. WHRII,560			l		j		g	me	
Melting Bon Chretien. Pr199. T'85,289. Syn. of Bon Chretien Fondante									
Managerie. F281	For.								Not described.
Menaud. L. Syns. Beurre Menand, Beurre Menaud	Fr.	obo	ml	y	dbmj	v		m	Described by Hogg in the Fruit Manual.
Mendenhall. IaH'00,88	Iowa?	p	s	y				ve	Not introduced; probably valuable for home use.
Menin. L. Syns. His Poiteau, Omer Pacha, Poire His, Poire St. Menin, Saint Menin.		obtp	ml	ybru	jm	sp	g vg	me	
Merod. R. Syn. Beurre Merod. [Possibly same as Boussock]		oblo	m	y	mj	p	vg	m	
Merriam. MagofH'53,459. E'54,377,'59,397. D'57,524,'69,815. H175. F274. AgR'58,397,'62,190. A'62,70. OH'64,12. AJofH'67,43. CGenXI,190. Hort'72,292. T'75,284,'85,302,'97,477. MassH'79,161. Bul6,8. AHM255.	Mass.	rob	m	yru	cojm	vp	g-vg	m	Originated at Roxbury, Mass.
Merriweather. D'57,551,'69,866. E'59,411. Syn. of Taylor									
Mertens. R. Syn. Mertens fils									Published in Magazine of Horticulture, 1855, p. 146.
Mertens fils. MagofH'55,146. Syn. of Mertens									
Merveille. L. Syns. Amadont, Amadot, Bouvar, Little Lord, Merveille d'Hiver, Merveille d'Hyver, Petit Oin, Rousset or Roussette, Wonder of Winter.		rp	s	gru	m	v	g	ml	
Merveille d'Hiver. Pr106. K'32,147'41,122. Cult'39,66. MagofH'43,131. H175. Syn. of Merveille.									
Merveille d'Hyver. C.198. Syn. of Merveille									
Merveille de la Nature. K'32,195,'41,162. Syn. of Diel									
Mervielle de Charneux. A'81,98. Syn. of Brabant									
Merville de la Nature. D'69,751. Syn. of Easter Beurre									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Messire. L. Syns. Brown Orange, Chaulis, Communaute, Convent, Coulis, Emmilacour, Gray Monsieur John, John, Marion, Messire Jean, Messire Jean Blanc, Messire Jean Golden, Messire Jean blanc and Gris, Messire Jean Dore, Messire Jean Gris, Mr. John, Monsieur Jean, Monsieur Brown Gold, Monsieur Jean and Mr. John, Monsieur Jean Dore, Monsieur John, White and Grey Messire Jean, White and Gray Monsieur John, White Monsieur John.	Fr.	t	m	ybru	gjbr	s	g	l	A very old variety; perhaps of little value.
Messire d'Hiver. D'69,875. Syn. of Vicar.									
Messire Jean. C194. Prs2. K'32,139,'41,122. MagofH'37,45. D'45,443,'57,578,'69,815. E'54,397,'59,423. H175. F281. T'75,551,'85,567,'97,709. OH'65,41. HMHS15. EFABC'00. Syn. of Messire.									
Messire Jean Blanc. D'45,443,'57,578,'69,815. E'54,397,'59,423. F281. Syn. of Messire.									
Messire Jean blanc & Gris. Prs2. Syn. of Messire.									
Messire Jean Dore. Prs2. K'32 138. MagofH'43,131. D'45,443,'57,578,'69,815. E'54,397,'59,423. Syn of Messire.									
Messire Jean Golden. F281. Syn. of Messire.									
Messire Jean Gris. E'54,397,'59,423. D'57,578,'69,815. F281. Syn. of Messire.									
Meuris. R. Syns. Ferdinand Demeester, Surpasse Meuris.	Belg.	rov	m	gye	jbru	s	g	m	Originated by Dr. John Van Mons.
Meuris d'Hiver. K'41,170. MagofH'42,250.									Not described.
Meuris (Ne Plus). L. Syn. Ne Plus Meuris.	Belg.	r	ms	ybru	b	s	g	vl	Raised by Dr. John Van Mons; named for his grandson, P. Meuris.
Meynier. R. Syn. Doy. Meynier.									Published in Horticultural Art Journal, 1888, p. 74.
Micado. IllH'92,323. Syn. of Mikado.									
Michaux. MagofH'39,295,'40,45,'42,60. D'45,398,'57,578,'69,816. A'54,239. E'54,387,'59,423. H176. F281. T'75,551,'85,567,'97,709. Syns. Compte de Michaux, Comte de Michaux.		rp	m	ygr	cobj	s	p	m	
Miel. R. Syn. Miel des Carmes.	For.								Published by Field, p. 281.
Miel des Carmes. F281. Syn. of Miel.									
Miel d'Waterloo. MassH'48,99,'51,175. MagofH'51,473. D'57,494,'69,747. F283. E'59,379. T'75,551,'85,567,'97,709. Syn. of Brabant.									
Mignard. R. Syn. Auguste Mignard.									Published in Gardeners' Monthly, 1872, p. 27.
Mignonne. L. Syn. Mignonne d'Hiver.	Belg.	obop	m	yeru	gjb	svp	g	l	Often very good; variable in quality.
Mignonne d'Hiver. D'57,525,'69,816. F281. E'59,398. T'75,551,'85,567,'97,709. Syn. of Mignonne.									
Mignot. FGAofO'93,146. EFABC'00.									In the experimental orchard at Agassiz, B. C.
Mikado IndH'78,64,'79,49,'88,39,'92,93. PaB18. MichH'80,84. OH'87,166. LaB22. GHM&S'90,'94. NYC'90. Bl229,244. PJB'01. Syns. Japanese, Micado.									An Oriental variety; only valuable for cooking.

Milanaise Cuvelier. K'41,167. D'45,550,'57,447,'69,884. HovI,15 E'54,346,'59,355. F283. Syn. of Winter Nelis.									
Milan and Milan Blanc. Pr68. GenF'37,277. Syn. of Summer Bergamot									
Milan Beuviere. K'32,132. Syn. of Summer Bergamot									
Milan Blanc. F276. Syn. of Bergamote d'Ete									
Milan Blanc. K'41,153. D'69,863. Syn. of Franc Real (Sum.)									
Milan Blanc. K'32,132. Syn. of Summer Bergamot									
Milan de Bourdeaux. D'69,670. Syn. of Cadet									
Milan de la Beuviere. F276. Syn. of Bergamote d'Ete									
Milan de la Beuviere. Pr68. GenF'37,277. Syn. of Summer Bergamot									
Milan de la Beuvriere. K'32,153,'41,120. D'69,863. Syn. of Franc Real (Sum.)									
Milan de Rouen. D'69,816. Syn. of Rouen									
Milan Vert. D'69,778. Syn. of Hampden									
Milepin. FGAofO'91,14. Syn. of Dame									
Millar. R. Syn. Millar's Seedling									Published in Magazine of Horticulture, 1850, p. 296.
Millar's Seedling. MagofH'50,296. Syn. of Millar									
Miller. WNYH'05,140. Syn. Miller's Seedling. [Most likely this and Millar are identical.]									Shown by Ellwanger & Barry at meeting of Western New York Horticultural Society, 1905.
Miller's Early. D'57,532,'69,828. F282. E'59,403. T'75,551,'85,567,'97,707. Syn of Portugal.									
Miller's Seedling. A'54,239. Syn. of Miller									
Miller's Victor. MoH'86,235. Syn. of Victor									
Millet. R. Syns. Beurre Millet, Beurre Millet of Angers, Millet (of Angers)	Fr	robo	m	gru	bjm	v	g-vg	l	Originated at Angers, France.
Millet (Madame). L. Syns. Madame Millet, Millett	Belg	obop	m	yru	j	vp	g	vl	Pronounced worthless at Michigan Experiment Station.
Millet (of Angers). T'97,709. Syn. of Millet									
Millipieds. L. Syns. Bergamotte de Millepieds, Bergamotte de Millipieds	Fr.	rov	m	y	jmg	s	g-vg	m	Origin with M. Goubalt at Millipieds, France.
Millot. MagofH'52,39. Syn. Millot de Nancy	Belg	obl	m	gy	m	s	g	m	Originated by Dr. John Van Mons.
Millot de Nancy. MassH'51,189,'53,19. Hort'53,30,'54,85. MagofH'54,84. E'54,378,'59,398. D'57,525,'69,816. H176. F281. T'75,265,'85,283,'97,462. Syn. of Millot.									
Milner. R. Syn. Milner's Favorite		p	s				g		Catalogued by Silas Wharton in 1824.
Milner's Favorite. SW. IndF'40,136,183. Syn. of Milner									
Milnes. R. Syn. Jas. de Milnes									Published in Arizona Experiment Station Bulletin No. 15.
Mina Wilder. MassH'74,152,'75,120	Mass.								Exhibited by Col. M. P. Wilder. Considered promising.
Ministre Bara. GaH'92,49,'93,53									Exhibited by P. J. Berckmans.
Mino. AoH'91,296									Introduced in 1891.
Mespored Benoist. D'69,716. Syn. of Catillac									
Missile. R. Syn. Missile d'Hiver			l		br			l	Valued by M. Jamin.
Missile d'Hiver. K'41,170. Syn. of Missile									
Mission. AgR'92,262. A'95,73	Cal								An old California variety; tree nearly a century old.
Messire d'Hiver. D'69,875. Syn. of Vicar									
Mr. John. C194. D'45,143,'57,578. E'54,397,'59,423. F281. Syn. of Messire									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Mrs. Jackson. D'69,789. Syns. Jackson, Jackson's Eliza, Jackson's Elizabeth, Jackson's Seckel, Jackson's Seedling.	Ohio	robop	m	gyeru	jm	sp	g-vg	me	Originated with S. S. Jackson, of Cincinnati, Ohio.
Mitchell. L. Syn. Mitchell's Russet	Ill	rp	ms	ybru	jm	a	g-p	m	Originated at Belleville, Ill.
Mitchell's Russet. Hort'47,246. A'54,122. AgR'54,256. D'57,525,'69,817. H176. F274. E'59,399. T'75,551,'85,567,'97,709. Syn. of Mitchell.									
Mitschurin. FGAofO'91,11. CanH'94,292	Rus.?		vl				g	m	Tree very hardy; a kitchen variety.
Moccas. K'41,163. MagofH'42,165,'47,153. D'45,443,'57,578,'69,817. B'51,317. Cult'52,36. E'54,378,'59,399. H176. F281. T'75,551,'85,567,'97,709	Eng	obo	m	g	j		p	l	Originated with Thomas Andrew Knight.
Mogul Summer. MassH'37,39. MagofH'40,18,19,'41,169. D'69,719. Syn. of Chelmsford.									
Mogul Summer. Pr147. Syn. of Harrison									
Moire. D'69,694. T'97,462. Syns. Belle de Moire, Beurre Moire, Beurre Moiret	Fr	oblp	l	gyr	gbm	p	g-vg	m	
Moise. L. Syn. Buerre de Moise	For								Published by Field, p. 287.
Molle Bouche d'Hiver. D'69,660. Syn. of Angelique									
Molle Bouche Nouvelle. D'69,760. Syn. of Flemish									
Mollet. L. Syns. Mollet's Guernsey Beurre, Mollet's Seedling Chaumontel	Eng	ovp	m	ygeru	mb	v	g	l	Raised by C. Mollet, of the Island of Guernsey, England.
Mollet's Guernsey Beurre. D'45,426,'57,472,'69,817. H176. MHSC'76,30. T'85,554. Syn. of Mollet.									
Mollet's Guernsey Chaumontelle. K'41,163. MagofH'42,164. D'45,426,'57,472. E'54,351,'59,361. MassH'51,175. T'97,709. Syn. of Guernsey.									
Mollet's Seedling Chaumontel. MagofH'40,46,'51,473. Syn. of Mollet									
Moltke. FEABC'00									In the experimental orchard at Agassiz, B. C.
Monarch. K'32,196,'41,163. GenF'37,278. B'51,317. CGenX,239. D'69,798. Syns. Knight's Monarch, Monarch Knight's, Monsieur Le Cure.	Eng	r	m	ygbru	m	s	g	l	Raised by Thomas Andrew Knight. Not valuable here.
Monarch Knight's. MagofH'47,155. Syn. of Monarch									
Monchalard. MassH'72,92		tap	ml	yb	mj	sp	g	me	Exhibited by Col. M. P. Wilder as a new variety.
Mondelle. L. Syn. Beurre Mondelle	Belg	roblp	m	gyru	gjm	p	g	m	But little known in America.
Mon Dieu. Pr37. D'45,383,'57,571,'69,656. E'54,394,'59,420. F276. Syns. Ah! Mon Dieu, Beurre Sprin, D'Abondance, D'Amour, Esperine, Mondieu, My God Pear, Poire d'Abondance, Poire d'Amour, The My God Pear.	Fr	obop	m	yr	j	vs	g	m	A very old variety; perhaps obsolete.
Mongolian. IllH'96,215. AHM256. Syns. Mongolian Snow, Mongolian Snow Pear.									This and Kieffer possibly identical. See Iowa Horticultural Report, 1900, p. 88.
Mongolian Snow. AHM256. Syn. of Mongolian									
Mongolian Snow Pear. N253. IllH'96,178,209,'02,213. IaB31. IaH'00,88. Syn. of Mongolian.									
Monkowthy. D'57,466,'69,661. F277. Syn. of Angleterre									
Monsallard. EFABC'00									In the experimental orchard at Agassiz, B. C.

Mons (Beurre). L. Syns. Beurre de Mans, Beurre de Mons.	Eur.	robo	s	ybr	gj	a	p	me	Rots at the core; not valuable.
Monseigneur Affre. MassH'53,21. MagofH'54,86. D'57,525,'69,817. F281. E'59, 399. T'75,552,'85,567,'97,709. Syn. of Affre.									
Monseigneur des Hons. MagofH'59,256. D'69,817. T'75,551,'85,567,'97,709. EFABC'00. Syn. of Hons.									
Monseigneur Sibour. D'69,817. AHortA'71,65. EFABC'00. Syn. of Sibour.									
Mons Jean. MagofH'51,482.									Mr. Hovey thought this name a misprint for Mons Jean.
Monsieur. Cult'47,340. HovI,47. D'69,875. Syn. of Vicar.									
Monsieur. GenF'33,196. Syn. of White Doyenne.									
Monsieur Brown Gold. Pr82. Syn. of Messire.									
Monsieur Jean. GarCal587. Th188. D'45,443,'57,578,'69,815. E'54,397,'59,423. Syn. of Messire.									
Monsieur Jean and Mr. John. Pr82. Syn. of Messire.									
Monsieur Jean Dore. K'41,122. Syn. of Messire.									
Monsieur John. K'32,138. F281. Syn. of Messire.									
Monsieur le Comte de Fresnel. MagofH'43,131. Syn. of Fresnel.									
Monsieur le Cure. Pr66. Syn. of Lezin.									
Monsieur Le Cure. L17. Syn. of Monarch.									
Monsieur le Cure. D'45,448,'57,557,'69,875. Cole168. B'51,310. HovI,47. E'54,344, '59,354. H172. F220. AgR'63,189. HMHS250. T'85,308,'97,709. Syn. of Vicar.									
Mons (Tardif). L. Syn. Tardif de Mons		obl		yru	dbmj	sl		ml	From the Fruit Manual.
Monstre. F279. Syn. of Catillac.									
Monstreuse de Landes. D'69,716. Syn. of Catillac.									
Monstreuse du Nord. D'69,873. Syn. of Van Marum.									
Monstrous Calabash. D'45,374. E'54,392,'59,419. Syn. of Van Marum.									
Monstrous Wood. F281. Syn. of Wood.									
Montcharlet. GalH'93,54.									Exhibited by P. J. Berckmans.
Montee. L. Syn. Haute Montee	For.								Published by Field, p. 280.
Montgeron. L. T'97,709. Syns. Beurre de Montgeron, Beurre de Montigeron, De Montgeron, New Frederick of Wurtemburg.	Fr.	p	m	yr	jm	v	g-vg	me	Obtained of M. Guyot in 1830.
Montica. R. Syn. of Beurre Montica									In the experimental orchard at Agassiz, B. C.
Montigny. L. T'97,709. Syns. Besi de Montigny, Beurre Cullem, Beurre Romain, Bezi de Montigny, Comptesse de Lunay, De Montigny, Doyenne Musque, Louise Bose, Musque, Trouve de Montigny.		obo	m	yg	mjb	sp	g	m	Found near Montigny, a town in France.
Montjean. R. Syn. Doyene de Montjean.									In the experimental orchard at Agassiz, B. C.
Montlucon. EFABC'00. Syn. Sucre de Montlucon.									Published in Gardeners' Monthly, 1872, p. 27.
Moon. L. Syns. Moon's Large, Moon's Pound, Pound Moon's.			m	y	mj		g	l	Cultivated by Silas Wharton in 1824.
Moon's Large. SW. Syn. of Moon.									
Moon's Pound. WHRIV,205. CGenXXIII,190. H176. Syn. of Moon.									
Moore. MagofH'36,461.									May be Hosenschenck.
Moore's. MagofH'60,502. A'62,70. T'85,296,'97,472. Syn. of Hosenschenck.									
Moore's Pear. D'69,784. Syn. of Hosenschenck.									
Moore's Pound. MagofH'53,40,'60,502. Hort'54,483. AgR'54,263. A'62,70. D'69,784. MassH'70,32. AtofHVIII,223. T'75,278,'85,296,'97,472. Syn. of Hosenschenck.									
Moore's White Pound. A'73,108. Hort'75,275. Syn. of Hosenschenck.									
Moor Fowl Egg. K'32,138. Pr196. MagofH'37,395. GenF'37,277. Cult'39,66. D'45,399. A'54,239. E'54,397,'59,423. H176. Syn. of Swan Egg.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavors.	Quality.	Season.	Remarks.
Moor fowl Egg (incorrectly). D'[illegible]. F282. T'75,551,'85,567,'97,709. Syn. of Swan Egg.									
Moorfowl Egg (of Boston). K'32,141,'41,128. M'38,59,'44,74. Cult'47,340. Syn. of Swan Egg.									
Moor's Pound. MagofH'46,248. Syn. of Hosenschenck.									
Morel. [illegible]	Eng	obo	m	yrn	cj	s		vl	A cooking pear. Description from Hogg.
Morgan. MagofH'[illegible]. Hort'[illegible]. T'75,552,'85,567,'97,709.	N. C.		l	yrn			g	m	Originated in Hanover County, N. C.
Morgan. D'69,780. Syn. of Hawes									
Morny. L. Syn. Duc de Morny	Fr	robtp	m	yrru	j	v	g	ml	Raised by M. Boisbunel, of Rouen, France.
[illegible]	Rus ?.								Mentioned by Prof. Budd; not described.
Morrel. [illegible]									Not described.
Morren. L. [illegible]	Eur	r	s	gb	jm	s	g vg	m	Origin not certainly known.
Mortefontaine. R. Syn. Beurre Mortefontaine								m	Mentioned in an address before the North American Pomological Congress, 1849.
Mortillet. R. Syn. Beurre Mortillet	Fr.		vl	yrb					Favorably mentioned in Canadian Horticulturist, 1902, p. 403.
Moscoe No. 4. NYC'90. [Possibly the same as Moscow]									
Moscow. [illegible]									In the experimental orchard at Agassiz, B. C.
Moskovka. MHSC'82,57. [illegible]	Rus.	p	s		j			c	Grown largely at Simbirsk, Russia, for cooking.
Mosselman. L. Syn. Senateur Mosselman	Eur.	robo	ms	gy	j	s	g	vl	
Mother's Favorite. BBL									In the trial grounds of Benjamin Buckman, Farmingdale, Ill.
Mouchouses. L. Syn. Beurre des Mouchouses	Fr.	robt	l	y	dmj	v		c	In Leroy's collection at Angers, France.
Mouchy. L. Syn. Duchesse de Mouchy.	Fr.	robtp	m	yrru	mj	s	g	vl	Found at Beauvaise, Breteuil, France.
Mouille Bouche. Cult'47,340. F276. Syn. of Bergamote d'Ete									
Mouille Bouche. E'59,410. Syn. of Franc Real (Sum.)									
Mouille Bouche. C195. Pr56. K'32,138,'41,170. E'54,331,'59,341. D'57,556,'69,803. F281. Syn. of Long Green.									
Mouille Bouche d'Automne. Pr56. Syn. of Long Green									
Mouille Bouche d'Automne. D'69,804. Syn. of Long Green (Aut.)									
Moulinoise. L. Syn. of Belle Moulinoise	Fr.	oblp	l	g	dbj	sm		vl	Originated at Moulins, France; fruited in 1864.
Mountain. L. Syn. Green Mountain Boy	Amer.	robop	m	yru	mj	s	vg	m	Described by Elliott.

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Mount Vernon. MassH'64,42,'66,46. Hort'68,67,'69,367,'71,314,361,'72,204. AJofH111,144. D'69,818. AHortA'69,79. S92. B'83,376. T'75,280,'85,298,'97,473. Bul6,8. Syn. Walker's Seedling.	Mass.	robtp	ml	ycru	gjm	vp	vg	l	Originated by Samuel Walker, Roxbury, Mass.
Mouthwater. Pr56. K'32,138. D'45,418,'69,803. Cult'47,340. Cole159. E'54,331,'59,341. Syn. of Long Green.									
Moyamensing. MagofH'47,274,'49,105,340,'52,492,'53,417. Cole153. Wg72. B'51,300. E'54,532,'59,399. H177. F274. Hof. D'57,525,'69,818. A'62,70. CGenIX,126. T'75,255,'85,273,'97,455. Syns. Smith's Early Butter, Smith's Moyamensing.	Pa.	rob	m	ygru	cojm	s	g	me	Originated by J. B. Smith, of Philadelphia, Pa.
Muddy Brook. MassH'66,45.	Mass.								Originated at Brookline, Mass. Fruited in 1862.
Mulky. T'97,709. Syn. of Idaho.									
Mundnetz. EFABC'00.									In the experimental orchard at Agassiz, B. C.
Muscadelle. Pr22. Syn. Muscadelle a Calyce Caduque.	Fr.	rp	s	gru	co	m		e	
Muscadelle a Calyce Caduque. Pr22. Syn. of Muscadelle.									
Muscadelle Rouge. Pr26. Syn. of Beauty (Sum.).									
Muscadel of Metz. R. Syn. Muscadel-Pear of Metz.				grb				l	Published by Domestic Encyclopedia in 1804.
Muscadel-Pear of Metz. DomEncIV,185. Syn. of Muscadel of Metz.									
Muscadet d'Ete. D'69,767. Syn. of Jargonelle (Fr.).									
Muscadine. MagofH'35,364,'42,63. D'45,342,'57,562,'69,818. M'47,94. NAPC'49,38. B'51,300. Wg72. AgR'54,293. E'54,378,'59,399. T'75,255,'85,273,'97,455. KanH'82,156. IaH'84,509.	N. Y.	oblp	l				g	me	Has a very high, musky flavor.
Muscadelle. D'69,668. Syn. of Brussels.									
Muscat Allemand. DomEncIV,180. K'32,145. Syn. of German Muscat.									
Muscat Allemande. C201. L187. Pr81. H177. D'69,772. Syn. of German Muscat.									
Muscat a longue Queue. K'41,122. Syn. of Rousseline.									
Muscat a longue queue d'Automne. Pr12,129. Syn. of Muscat Fleuri.									
Muscat a longue Queue de la fin d'Automne. Pr90. K'32,140. Syn. of Rousseline.									
Muscat d'Allemagne. D'69,772. Syn. of German Muscat.									
Muscat d'Ambre. F281. D'69,818. Syn. of Muscat Robert.									
Muscat d'Aout. K'32,126. GenF'32,277. Syn. of Aurate.									
Muscat de Nancy. Pr12. Syn. of Aurate.									
Muscat Fleure. Pr56. D'45,418. E'54,331,'59,341. Syn. of Long Green.									
Muscat Fleuri. Pr12,129. K'41,118. Syns. Flowered Autumn Muscat, Flowered Muscat, Long Stalked Muscat of Autumn, Muscat a longue queue d'Automne.		robl	s	gy	m			ve	An old variety; small and perhaps worthless.
Muscat l'Aleman. D'69,772. Syn. of German Muscat.									
Muscat l'Alleman. Pr81. K'32,145. D'69,772. Syn. of German Muscat.									
Muscat l'Allemand. K'41,126. F281. D'69,772. Syn. of German Muscat.									
Muscat Lallemand. Pr81. D'69,772. Syn. of German Muscat.									
Muscat (of Germany). Pr81. D'69,772. Syn. of German Muscat.									
Muscat Pear (of August). K'32,131. Syn. of Robine.									
Muscat Petit. Pr10. D'45,340,'57,577,'69,802. E'54,397,'59,442. F281. T'75,552,'85,567,'97,709. Syn. of Little Muscat.									
Muscat Robert. DomEncIV,187. Pr11. K'32,130. GenF'33,197,'37,277. Cult'39,66. MagofH'42,376. D'45,341,'57,578,'69,818. B'51,301. Wg72. E'54,397,'59,423. F281. T'75,552,'85,567,'97,709. Syns. Amber, D'Ambre, Beurre a la Reine, Early Queen, Great Musk pear of Cone, Gros Saint Jean Musque, La Princesse, Maiden of Flanders, Maiden of Xaintonge, Muscat d'Ambre, Muscat Robine, Musk Robine, Poire a la Reine, Poire d'Ambre, Pucelle de Xaintonge, Queen, Queen's Amber, Queen's Pear, Robine, Robert's Muskateller, St. Jean Musque Gros, The Princess, Virgin of Xaintonge.	Fr. ?	rovp	s	gycru	bj	s	g	ve	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Muscat Robert. K'41,118. H177. Syn. of Little Muscat									
Muscat Robine. Pr11. K'32,130. D'45,341,'69,818. Syn. of Muscat Robert									
Muscat Rouge. D'69,668. Syn. of Brussels									
Muscat Rouge. Pr12. Syn. of Red Muscat									
Muscat Royal. Pr11. K'41,126. MagofH'43,131. Syn. of Muscat Royale									
Muscat Royale. K'41,119. Syns. Muscat Royal, Royal Muscat		oblp		yru	m	sp		me	
Muscat Roye. Pr134		obl	s	ygr	b	p	g	e	
Muscat Verd. Pr31. K'32,127. Syn of Cassolette									
Muscat Vert. Pr31. Syn. of Cassolette									
Musette d'Anjou. Pr15. D'69,775. Syn. of Blanquette									
Musette d'Automne. Pr113. K'32,148,'41,122. Syn. of Pastorale									
Musk. GarCal587. MassH'44,65									Shown by R. Ward at meeting of Massachusetts Horticultural Society, 1844, p. 65.
Musk Blanquet or Blanquette. Pr17. K'32,128. D'69,802. Syn. of Little Blanquet									
Musk Drone. Pr25. Syn. of Drone									
Muskingum. Cole153. B'51,317. MassH'51,188. MagofH'52,38,149,'54,467. E'54,397,'59,460. D'57,526,'69,819. F274. A'62,211,'64,69. PaFS'71,64. Hort'72,130. CGenXXIII,288. T'75,257,'85,275,'97,456.	Conn. ? Ohio ?	r	m	gyru	m	v	g	me	It is claimed in proceedings of American Pomological Society, 1862, p. 210, that it originated in Connecticut.
Musk Orange. C183. Pr40. H178. Syns. Bourdon Musque, Orange d'Ete, Orange Musk, Orange Musque.		r	m	yr	brj	p	g	me	
Musk or Spice. GenF'37,277. Syn. of Aurate									
Musk Robine. Pr11. GenF'37,277. E'54,397,'59,423. D'57,578,'69,818. F281. Syn. of Muscat Robert.									
Musk Spice. SW. Syn. of Rheims									
Musk Summer Bon Chretien. C185. Pr59,61. K'32,139'41,119. D'45,346,'57,583,'69,863. E'54,399,'59,424. H177. F282. T'75,552,'85,567,'97,709. Syn. of Bon Chretien (Sum.).									
Musk Summer Bon Chretien. K'32,139,'41,119. MagofH'37,50. WHRIV,204. AgR'54,263. Syn. of Bon Chretien Fondante.									
Musky Bourdon. Pr25. Syn. of Drone									
Musque. T'97,709. Syn. of Montigny									
Musque d'Esperne. F281. Syn. of Esperne									
Musquine de Bretagne. D'69,784. Syn. of Hollande									
My Belle. MHSC'77,114									Mentioned in Montreal Horticultural Society Report; not described.
My God Pear. K'32,153,'41,120. Syn. of Mon Dieu									
Naaman's Creek. D'69,878. Syn. of Washington									
Nabors. A'73,75. Syn. of Nabours									
Nabours. MagofH'59 542. Hort'59,349. A'73,60,119. AgR'75,380. T'75,552,'85,567,'97,709. Syns. Green Cluster, Nabors, Neighbors.	Ga	ap	ml	gy	jb	s	vg	me	Little known except in the South.
Nain. L. Syns. Angleterre Nain, Angleterre Parfume	Fr	obtp	sm	gr	jg	p		m	Originated at Paris, France.

Namen's Creek. D'69,878. Syn. of Washington									
Nain Vert. F281. Syn. of Wood									
Nancy. L. Syn. Marianne de Nancy	Belg	oblp	ml	ygru	bmj	vs		m	Raised by Dr. John Van Mons. Described in Album of Pomology.
Nana. Dap155. Syn. of Elizabeth									
Nantais. A'62,66. B'83,282. T'97,462. Syn. of Nantes									
Nantes. L. T'97,710. Syns. Beurre Blanc de Nantes, Beurre de Nantes, Beurre Nantais, Nantais.	Fr	p	l	gyr	jm	sp	vg	m	Raised by M. Maisonneuve, of Nantes, France.
Nantes (Marie). L. Syn. Marie de Nantes	Fr	obop	s	ybru	jm	s	vg	ml	Originated by M. Garnier in 1853.
Napa. L. Syn. Napa Seedling	Cal		vl					m	Resembles Angouleme. Introduced by Leonard Coates in 1886.
Napa Seedling. WnL332. A'95,68. Syn. of Napa									
Naples. L. Syns. Beurre Bronzee, Bezi de Naples, Comtesse de Frenol, De Naples, De Vigne Pelone, Fig Pear of Naples, Figue of Naples, Figue de Naples, Fourcroy.	Belg	obop	m	gyrru	jm	s	g-vg	m	
Naples. Pr78. K'32,147. Syn. of Lent									
Napoleon. Pr204. K'32,179,'41,149. GenF'33,197,'41,18. M'38,87,'44,74,'47,77. MagofH'44,129. D'45,401,'57,526,'69,819. Cole165. Wg72. AgR'53,280,'54,256. E'54,378,'59,400. H177. F249. T'75,265,'85,283,'97,462. Syns. Belle Canaise, Belle Caenais, Beurre d'Autien, Beurre Napoleon, Bois Napoleon, Bonaparte, Bon Chretien Dore, Bon Chretien Napoleon, Captif de Sainte Helene, Captif St. Helene, Charles, Charles d'Austria Incor, Charles d'Austriche, Charles X, Eliza d'Heyst, Gloire de l'Empereur, Liart, Mabille, Mailanderin Grosse Grune, Medaille, Melon, Napoleon d'Hiver, Napoleon Vrai, Poire Liard, Poire Napolion, Roi de Rome (erroneously), Sauvageon Liart, Sucree Doree, Sucre Douce, Wurtemburg (incorrectly).	Belg	obtp	ml	gy	mj	sp	g	me	Originated in 1808 by M. Liard, gardener at Mons.
Napoleon. Pr.101. Syn. of Passe Colmar									
Napoleon (Bon Chretien). L. Syn. Bon Chretien Napoleon	Fr		l		b			ml	Received from France about 1840.
Napoleon d'Hiver. MagofH'48,209,'54,137. D'69,819. Syn. of Napoleon									
Napoleon Peach. IndH'90,158									Grown in Australia; reported by F. M. Webster.
Napoleon (Prince). L. Syns. Prince Napoleon, Prinze Napoleon	Fr	rp	m	gbru	dj	sp		l	Introduced by M. Boisbunel, of Rouen, France.
Napoleon Savinien. D'69,819. EFABC'00. Syn. of Savinien									
Napoleon Vrai. D'69,819. Syn. of Napoleon									
Naumkeag. K'32,180,'41,149. M'38,79, 44,65. D'45,402,'57,579,'69,819. E'54,397, '59,423. H178. F274. T'75,552,'85,567.	Mass	r	m	yru	jm	a	g	m	A native of Salem, Mass.
Naver. R. Syn. Beurre Naver		t	m		mj	v	vg	m	Described by Elliott, 1859, p. 365.
Navet. A'54,259									Rejected by the Congress of Fruit Growers, 1849.
Navez. R. Syns. Beurre de Wael, Beurre Navez, Beurre Noisette, Colmar Navez, Josephine Bouvier, Louis Bosc.	Belg	obp	l	y	jm		g	m	Raised by Dr. John Van Mons; introduced by M. Bouvier.
Navez. MassH'45,89. Syn. of Peintre									
Navez Peintre. D'69,819. Syn. of Peintre									
Nectarine? F281. D'69,846. Syn. of Enfant Prodigue									
Nees. L. Syn. Fondante de Nees			l	byru	b			m	Described by Hogg in the Fruit Manual.
Negley. MagofH'60,267,397. Hort'60,229,255,515. D'69,820. T'75,552,'85,567,'97, 710. CanH'81,37.	Pa	obtp	ml	yeru	cojm	sp	g-vg	me	Originated at Pittsburg, Pa.; introduced by J. S. Negley.
Neige blanche. F279. Syn. of White Doyenne									
Neighbors. A'58,185,'73,75. AgR'58,394,'75,380. Syn. of Nabours									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Neill. Cult'39,66. E'54,398. H144. Syn. of Niell									
Nelis d'Hiver. Pr132. GenF'33,197. K'32,199,'41,167. MagofH'44,127. D'45,450, '57.447, '69,884. E'54,346, '59,355. HovI,15. F205. AgR'62,190. Syn. of Winter Nelis.									
Nelis Winter. L17. Syn. of Winter Nelis									
Nemours. R. Syn. Duke de Nemours									In the experimental orchard at Agassiz, B. C.
Nec Plus Meuris. F208. AgR'62,180. EFABC'00. Syn. of Anjou									
Ne Plus Meuris. GenF'33,197. Cult'39,66. MagofH'41,286. D'45,444, '57,527, '69, 820. F281. WHRI,131. E'59,400. T'75,552, '85,567, '97,710. AofH'89,151,'90,202. Syn. of Meuris (Ne Plus).									
Ne Plus Meuris (of the French). HovI,61. K'41,164. E'54,316, '59,330. D'57,423, '69,679. H178. F208. A'62,66. B'83,366. Syn. of Anjou.									
Nerchman. R. Syn. Doyenne Nerchman									Published in Magazine of Horticulture, 1847, p. 562.
Neue Crassane. D'69,829. Syn. of Passe Crassane									
Neufmaisons. F281. MassH'58,74. MagofH'59,41. Syn. of Serrurier									
Neuve Maison. F281. Syn. of Serrurier									
New Autumn. E'54,331,'59,341. Syn. of Long Green									
New Bartram. A'60,97	Pa.?								Referred to in discussion as a promising new sort.
New Boussouck. F200. Syn. of Boussock									
New Bridge. Pr204. MagofH'43,131. D'69,820		p	ms	grub	mg	s	p	m	Described by Lindley.
Newburg. FGAofO'73,7, 83									Not described.
New Colmar. L. Syn. Colmar d'Automne Nouveau	For	obtp	m	yeru	jm	v	vg	me	Mr. Downing received this variety from France.
New Frederick of Wurtemburg. D'57,468,'69,684. F277. E'59,364. A'64,66. T'75, 539, '85,553,'97,709. Syn. of Montgeron.									
New Gray Winter Vergalieu. F241. Syn. of Alencon									
Newhall. MassH'67,37,'77,80. AHortA'69,79. A'69,50,100. D'69,820. Syn. Clapp No. 12.	Mass.	obtp	l	yrru	jb	sp	vg	m	Raised by Thaddeus Clapp, of Dorchester, Mass.
New Haven. MagofH'37,327. Syn. New Haven Beauty	Conn.								Originated at New Haven, Conn.
New Haven Beauty. MagofH'47,562,'51,572. Syn. of New Haven									
New Holmar. Pr209. Syn. of Holmore									
New Long Rosewater. MagofH'44,37,'52,189,'53,104. MassH'44,64. Syn. of Rose (Sum).									
New Pear. E'54,332,'59,344. Syn. of Poiteau									
New St. Germain. L. Syns. St. Germain Nouveau, Van Mons St. Germain	Belg.	oblp	ml	gyru	mj	sp		me	Raised by Dr. John Van Mons; regarded by him as promising.
New St. Germain. D'45,447,'57,548,'69,837. E'54,335,'59,348. Syn of Germain (Prince).									
New Simon Bouvier. L. Syn. Noveau Simon Bouvier	For								Published by Field, p. 281; not described.

New Spring Beurre MagofH'56,84. D'69,875. Syn. of Verulam									
New Swan's Egg. Cult'39,66. MagofH'43,132. E'54,400,'59,425. Syn. of Swan Egg.									
Newtown. D'69,820. Syns. Newtown Seedling, Newtown Vergalieu	N. Y.	robo	m	yru	com	s	g	me	Originated at Newtown, Long Island, N. Y.
126 *Newtown Seedling.* F274. A'58,196. D'69,820. Syn. of Newtown									
Newtown Vergalieu. K'32,147,'41,164. MagofH'37,15. M'38,91,'44,78,'47,79. L18,19. Syn. of Newtown.									
Newtown Virgalieu. D'57,575 F274 T'75 552,'85,567,'97,710	N. Y.							l	Seems to be distinct from Newtown.
New Winter Gray Doynne. E'54,321. Syn. of Alencon									
New York Red Cheek D'45,415,'57,443,'69,852. Cole162. HovII,33. E'54,335,'59,347. L18. Syn. of Seckel.									
Nicaise. R. Syn. Henri Nicaise									Published by Magazine of Horticulture, 1853, p. 109.
Nicholas. L. Syn. Rousselet St. Nicholas	Belg	robo	ms	yeru	jm	sv		m	
Nicholas (Mass.). MassH'69,10,'76 94. Syn. Clapp No. 17	Mass							m	Origin with Clapp Bros.; exhibited at meeting of Massachusetts Horticultural Society, 1869.
Nickerson. D'69,820. T'75,552,'85,567,'97,710. MeP'76,121,'78,14,'82,15,'84,16,'89,49. CGenXXIII,94. Syn. Nickerson Seedling.	Me	oblp	l	gyr	jm	vs	g	m	Raised by Gov Huntoon at Readfield, Me.
Nickerson Seedling. CGenXXIII,94. Syn. of Nickerson									
Niell. D'45,401,'57,526,'69,821. F281. T'75,552,'85,567,'97,710. Syns. Beurre Neill, Beurre Niell, Colmar Bosc, Colmar Neill, Colmar Niel, Fondante du Bois (incorrectly), Neill, Poire Neil, Poire Neill, Poire Niell.	Belg	obop	l	yrru	bj	s	g vg	me	Raised in 1815, by Dr. John Van Mons; named for Dr. Niell.
Niell. E'59,330. AgR'62,180. Syn. of Anjou									
Niell d'Hiver. H178						a		l	Shown at meeting of Cincinnati Horticultural Society, 1855.
Niles. MagofHort'54,76. Hort'56,51. A'56,145. WHRIV,56. AgR'56,405. D'57,527,'69,821. F281. IllH'69 155.	Eur.?	obtf	l	yru	jb	s		l	Imported by J. M. Niles, of Hartford, Conn.
Nina. FGAofO'92,111. EFABC'00. CanExFR'02,379. Syn. of Elizabeth									
Nivelles. L. Syn. Beurre de Nivelles	Belg	obtp	m	ybru	jm	v	g	m	But little known in America.
No. 2 Knight. BBL									In Benjamin Buckman's trial orchard.
No. 2 Mission. BBL									In Benjamin Buckman's trial orchard.
No. 1 of Dana. MagofH'53,108. Syn. of Martha Ann									
No. 2 of Dana. MagofH'52,467,'56,477									Perhaps never named and disseminated.
No. 5 of Dana. MagofH'53,28									Perhaps never named and disseminated.
No. 10 of Dana. MagofH'53,28. Syn. of Augustus									
No. 16 of Dana. MagofH'53,28,108. Syn. of Danas Hovey									Perhaps the first mention of the variety.
No. 1 Petter. BBL									In Buckman's trial orchard at Farmingdale, Ill.
No. 3 Petter. BBL									In Buckman's trial orchard at Farmingdale, Ill.
No. 8 of Van Mons MagofH'42,57. E'54,390,'59,396. Syn. of Limon									
No. 10 of Van Mons. D'45,333,'69,802. Syn. of Limon									
No. 135 Van Mons. F283. D'69,877. Syn. of Walker									
No. 1295 of Van Mons. MagofH'51,473.									Perhaps unnamed.
No. 1325 of Van Mons. MagofH'51,473.									Perhaps unnamed.
Nos. 1482, 1082, and 1602 of Van Mons. E'54,323,'59,393. Syns. of Witte									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
No. 1599 of Van Mons. MagofH'42,64. D'45,362,'57,566,'69,692. E'54,390,'59,418. Syn. of Kenrick.									
No. 347. NebH'89,55'90,245. Syn. of Gakovsk									
No. 508. NebH'89,54,'90,244. Syn. of Bessemianka									
Noel. L. Syns. Apres Noel, Belle Apres Noel, Belle de Noel, Fondante de Noel, Fondante Noel, Souvenir Esperen.	Belg	obtp	l	yeru	cojm	a	g	me	
Noel. E'54,358,'59,371. Syn. of Christmas									
Noirchain. Cult'47,340. D'57,473,'69,696. L15. Syn. of Rance									
Noir Grain. Pr151. K'32,180. Syns. Beurre Noir Graine, Black Seeded, Black Seeded Beurre.			m					me	An old and perhaps worthless variety.
[illegible]. [illegible]. F277. T'97,710. Syn. of Angleterre									
Nones. D'57,431,'69,732. Syn. of Dearborn Seedling									
Nonholm. R. Syn. Nonholm Seedling									Published by Magazine of Horticulture, 1843, p. 131.
Nonholm Seedling. MagofH'43,131. Syn. of Nonholm									
Nonpareil. MagofH'55,198,225. E'59,400. D'69,821	N. Y.	rob	s	yru	dimj	sv		l	Raised by Judge Livingston, of New York.
Non Pareil Bergamot. DomEncIV,186. Th188. Syn. of Sanspareil									
Nonpareille. D'69,702. Syn. of Sanspareil									
Norfolk County. MassH'66,44	Mass.								Originated by Dr. S. A. Shurtleff, Brookline, Mass. Fruited in 1862.
Norris Pear. D'69,791. Syn. of Gratioli									
Northford Seckel. Dap154. A'81,123. Syn. of Talmadge									
Northford Seedling. CtP'99,155. Syn. of Talmadge									
Notaine Minot. Hort'73,37. Syn. of Notarie									
Notarie. L. Syns. Notaine Minot, Notarie Minot	Belg	obtp	m	gyrru	mj	sp		m	Raised by Dr. John Van Mons. Published in Album of Pomology.
Notarie Minot. MagofH'51,67,'52,474. D'69,821. Syn. of Notarie									
Nouv-Cours Complet. K'41,131. Syn. of Brussels									
Nouveau Maison. D'69,854. Syn. of Serrurier									
Nouveau Maurion. D'69,854. Syn. of Serrurier									
Nouveau Poiteau. Hort'46,140,'51,112. MagofH'47,451,'50,545,'51,441,'53,20. Cult'53,344. B'51,318,'83,382. AgR'53,282,'54,245. CGenII,202. E'54,332,'59,344. D'57,527,'69,821. H178. F250. A'62,70. T'75,265,'85,283,'97,463. Syn. of Poiteau.									
Nouveau Simon Bouvier. F281. Syn. of New Simon Bouvier									
Nouvelle. F282. E'59,409. Syn. of Saint Dorothee									
Nouvelle Boussouck. F200,279. Syn. of Boussock									
Nouvelle d'Ouej. D'57,436,'69,880. F279. AgR'62,183. Syn. of White Doyenne									
Nouvelle Dore. MagofH'43,131									Not described.
Nouvelle Fulvie. MagofH'57,155,302. D'69,822. AofH'92,277. EFABC'00. Syn. of Fulvie.									
Nouvelle Gagnoa Heuze. F280. Syn. of Flemish									

Nouvelle Mabille. MagofH'45,355. NAPC'49,38.									Mentioned by Dr. Wendell in address before North American Pomological Convention, 1849.
Nova Anglae HAJ'88,74.									Not described.
Nova Marie Louise. MagofH'43,388. AHortA'70'77. RNY'69,120									See Rural New Yorker, 1869, p. 120.
Noveau Poiteau. IllH'89,346. Syn. of Poiteau.									
November. R. Syn. Fondante de November.									Published in Magazine of Horticulture, 1843, p. 131.
Nun's Pear. D'69,'81. Syn. of Brignais									
Nuremburg. R. Syn. Nuremburg, Beurre de.									Published in Magazine of Horticulture, 1837, p. 51.
Nuremburg, Beurre de. MagofH'37,51. Syn. of Nuremburg.									
Nutmeg Pear. D'69,700. Syn. of Caissoy.									
Oakleaf C296. SW. A'69,114. Syns. Imperial, Imperiale, Imperial Oak-leaved, Oak-Leaved, Oak-Leaved Imperial, Imperiale a feuilles de Chane.		ovp	ms	gru	mj	s	g	vl	Of unknown origin; probably of little value.
Oak-leaved. Pr116. Syn. of Oakleaf.									
Oak-leaved Imperial. A'54,239. D'69,822. Syn. of Oakleaf.									
Oakley. L. Syns. Oakley Park, Oakley Park Bergamot.	Eng.	robo	m	gyru	bm			m	Raised by Dr. Thomas Andrew Knight.
Oakley Park. E'54,378,'59,400. Syn. of Oakley.									
Oakley Park Bergamot. MagofH'47,152. E'54,378,'59,400. D'69,822. Syn. of Oakley.									
Obdam. L. Syn. General Obdam.									Published in Magazine of Horticulture, 1842, p. 250.
Oberdieck. R. Syn. Calebasse Oberdieck.									Published in Gardeners' Monthly, 1872, p. 27.
Occletree. AgR'72,463. IndH'72,50,'78,87. Syn. of Ockletree.									
Ocheltree. IndH'68,72. Syn. of Ockletree.									
Ochsenherzbirn. MHSC'85,28.	Rus.?	p	l					m	Mentioned by Charles Gibb, in Montreal Horticultural Society's report.
Ockletree. MagofH'42,403. Cult'42,199,347. HMHS37. ColoH'97,87. Syns. Benefield, Occletree, Ocheltree, Mammoth, Vincennes.	Ind.	oblp	ml	yru	cog		p	m	Original tree celebrated for its immense size. A description appeared in Magazine of Horticulture, 1842, p. 403.
October. L. Syns. Calebasse d'Octobre, Cramoisi, Cramoisine, Inconnue Cramoisine, October Crimson.	Belg.	obtp	l	yer	djm	v		m	
October Crimson. Pr86. Syn. of October.									
Œlenghem. L. Syn. Cure d'Oelenghem.	For.								Published by Field, p. 279.
Œuf. D'69,822. Syns. D'Œuf, Œuf de Cygne.	Eng.?	oval	s	gy	dm	sp		me	Described by Hogg in the Fruit Manual.
Œuf de Cygne. MassH'46,150. Syn. of Œuf.									
Ogereau. MichB177. MichH'95,54. P'95,38. IllH'01,253,378,'02,220. AHM257. Syns. Anna Ogereau, Ami Ogereau, Anne Ogereau, Annie Ogereau.		oblp	l	yrru	coj	v	g	ml	H. M. Dunlap thinks that this is Clairgeau.
Ognon. D'45,345,'57,583. F282. Syn. of Rose (Sum.)									
Ognon de Xaintonge. D'69,863. Syn. of Rose (Sum.)									
Ognonet. Pr24. K'41,118. Syn. of Archduke.									
Ognonet de Provence. Pr24. Syn. of Provence (Ogn.)									
Ognonet (incorrectly of some). D'45,367. E'54,366. Syn. of Beauchamps.									
Ognonet Musque. D'69,862. Syn. of Archduke.									
Ognonet of Provence. Pr24. Syn. of Provence (Ogn.)									
Ognonnet. Pr24. K'32,132. D'69,862. Syn. of Archduke.									
Ognonet (incorrectly). F276. Syn. of Bufo.									
Ogonka. Gb	Rus.								Introduced into America in 1882.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Oicorska. Gb. Syn. of Keepsake									
Oignonet. D'69,862. Syn. of Archduke									
Oiran. AofH'91,296									Not described.
Oisan. R. Syn. Bergamotte d'Oisan			vl						Published in the Horticulturist, 1857, p. 189.
Okago. AofH'91,296									Not described.
Oken. D'69,822. Syns. Beurre Oken, Cent Couronnes, L'Oken d'Hiver, Oken d'Hiver, Winter Oken.	Belg	rob	m	gb	jm	v	g-p	m	
Oken d'Hiver. Cult'47,340. MagofH'52,151. AgR'54,243. D'69,822. Syn. of Oken									
Old Crassane. BBL									Being tested by Benjamin Buckman, Farmingdale, Ill.
Oldfield. Pr210. MagofH'37,60. GenF'37,278. CGenX239	Eng	t	s	gru					Name applied to a class of perry pears.
Old Home. BBL									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Old Kentucky Home (of Stark Bros.) SBro. IllH'96,45,'194,'98,336,'99,203. Syn. of Kentucky.									
Oliver. L. Syn. Oliver's Russet	Mass	r	ms	yerru	co	p	p	me	Origin with Miss Oliver, of Lynn, Mass.
Oliver's Russet. MagofH'44,212,'48,337,'51,472. Cole163. E'54,398,'59,423. D'57,579,'69,822. F274. T'75,552,'85,567,'97,710. Syn. of Oliver.									
Olivier. L. Syn. Olivier de Serres	Fr	r	ml	yrru	dmj	sp		vl	Origin with M. Boisbunel, of Rouen, France.
Olivier de Serres. D'69,822. AJofHIX,377. MoH'87,96. AofH'91,296. WNYH'93,41,'96,25. E&B'94,'02. IllH'96,204. AHM257. Syn. of Olivier.									
Omer Pacha. MagofH'55,87. D'57,549,'69,850. E'59,400. F281. A'60,99. AJofH VIII,222. T'75,278,'85,296,'97,473. MassH'76,93. Syn. of Menin.									
Oneida. D'69,823	N. Y	r	ms	yru	cojm		g	me	Origin in western New York; perhaps in Oneida County.
Onethird. IaH'79,219	Wis.								Third generation of seedlings raised by G. P. Peffer.
Onge. R. Syn. Blanquet St. Onge									Published in Horticultural Art Journal, 1888, p. 74.
Onondaga. MagofH'46,492. Hort'47,322. Cult'48,207,'51,210. Cole165. AgR'50,94,'56,337. WHRII,350. HovI,21. B'51,307,'83,372. E'54,331,'59,401. H195. F251. D'57,528,'69,823. A'62,70. AHortA'68,80. T'75,265,'85,283,'97,463. WnI,326,II,336,III,259. AHM257. Syns. Francis Borgia, Kilmer, Onondaga Seedling, Onondaga Seedling (of some), Orange, Swan's Orange.	Conn.?	ovp	l	yru	bmjg	s	g-vg	m	Mr. Downing thought it a seedling of western New York, while a correspondent of the Horticulturist, 1847, p. 243, claims its origin for Farmington, Conn.
Onondaga Seedling. Hort'47,322. HovI,21. E'54,332,'59,401. Syn. of Onondaga									
Onondaga Seedling (of some collections in western New York). HovI,21. Syn. of Onondaga.									
Ontario. A'56,200. MagofH'57,110. Hort'57,112,530,'68,331. D'57,529,'69,824. AHortA'69,79. Cult'57,372. F274. E'59,402. CGenIX,191,X,286. T'75,265,'85,K283,'97,463.	N. Y	oblp	m	yru	mjbg	s	g-vg	me	Originated at Geneva, Ontario County, N. Y.

Onyn. R. Syn. Chevalier d'Onyn									Published in Magazine of Horticulture, 1855, p. 146.
Orange. Tuls. Pr40. MagofH'50,296. D'69,824. MassH'74,152. GaH'92,50. Syns. Orange d'Automne, Orange Rouge, Red Orange.		r	m	yru	m	s		me	Old and probably valueless.
Orange (Mass.) MassH'66,44	Mass.								Originated by Dr. S. A. Shurtleff at Brookline, Mass. Fruited in 1862.
Orange. A'54,239,'75,101,'79,81. HMHS15,16. Syn. of American Orange									
Orange. F251. Syn. of Onondaga									
Orange Bergamot. GarCal587. C205. K'32,139. Cult'39,66. WHRIV,204. AgR '51,293. T'75,552,'85,568,'97,710. Syns. Orange Bergamotte, Orange Pear.		obop	m	y	gb	a		me	Only valued for cooking.
Orange Bergamot (erroneously). Hort'54,493. D'57,534,'69,832. Syn of Philadelphia.									
Orange Bergamotte. K'41,127. E'54,378,'59,402. D'57,579,'69,824. Syn. of Orange Bergamot.									
Orange d'Automne. Pr40. D'69,824. Syn. of Orange									
Orange d'Ete. Pr25. Syn. of Drone									
Orange d'Ete. Pr40. K'41,118. D'69,824. Syn. of Musk Orange									
Orange d'Hiver. C196. Pr41. K41,125. E'54,401,'59,425. D'57,579,'69,824. F281. Syn. of Winter Orange.									
Orange d'Hyver. SW. Syn. of Winter Orange									
Orange Mandarine. D'69,824. Syn. of Mandarine									
Orange Musk. Pr40. D'69,824. Syn. of Musk Orange									
Orange Musque. C183. Pr40. K'32,130,'41,119. MagofH'43,131. H178. D'69,824. Syn. of Musk Orange.									
Orange Pear. E'54,378,'59,402. Syn. of Orange Bergamot									
Orange (Princesse). L. Syns. Princesse Conquete, Princess Conquette, Princesse d'Orange, Princess of Orange.	Fl	r	m	crru	coj	a	p	m	Raised by Count Coloma in 1802.
Orange Rouge. Pr40 K'41,119. MagofH'43,131. A'54,239. D'69,824. Syn. of Orange.									
Orange Russet. AofH'92,277									Not described.
Orange Sept. L. Syn. September Orange		p		y			p	me	Published by Kenrick, 1832, p. 140.
Orange Striped. L. Syns. Bigarrade, Great Orange, La Villaine d'Anjou, Orange Tulipee, Poire aux Mouches, Poire Tulipee, Striped Orange, Tulip or Fly-pear, Tulip Pear, Villaine d'Anjou.		ovp	ml	gbr	mj			me	Described by Dr. Lindley.
Orange Tulipee. K'32,130,'41,120. Pr42. MagofH'43,131,'50,296. A'54,239 D'69,825. Syn. of Orange Striped.									
Orchard. SW									Cultivated by Silas Wharton in 1824.
Ordynka. CanH'94,292									Published in Canadian Horticulturist, 1894, p. 292.
Oregon. MagofH'51,473									Exhibited by Winship & Co., September, 1851.
Orel. IaB3. IllH'96,178,'04,205									In the trial orchard at Illinois Experiment Station No. 1.
Orel No. 15. IllH'96,187. [Possibly not named and disseminated]									
Orel No. 16. CanExFR'96,136 [possibly not named and disseminated]									
Orleans T'97,490. Syns. Beurre St. Nicholas, Doyenne Fondante, Duc d'Orleans, Duchesse d'Orleans, Duchesse of Orleans, St. Nicholas.	Fr	p	ml	yg	jm	v	vg	m	
Orpha. EFABC'00. CanExFR'02,380									In the experimental orchard at Agassiz, B. C.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Orpheline. L. Syn. Orpheline Colmar	Belg.	p	vl	gyru	dmgj	sp	......	m	Raised by Dr. John Van Mons. Described in Album of Pomology.
Orpheline Colmar. D'57,529,'69,825. F281. E'59,402. MagofH'60,220. T'75,552,'85,568,'97,710. Syn. of Orpheline.									
Orpheline d'Enghien. Cult'47,340. E'54'314,'59,326. F230. AgR'65,188. D'69,680. EFABC'00. Syn. of Aremberg.									
Osband. Bul6,8. AHM257. Syns. Osband's Favorite, Osband's Summer, Summer Virgalieu.	N. Y.	robop	s	yru	jm	sp	vg	me	Originated in Wayne County, N. Y.
Osband's Favorite. MagofH'46,211. E'54,379,'59,402. D'69,825. Syn. of Osband									
Osband's Summer. Hort'46,211,'55,160,'71,322. MagofH'49,106,'51,259. Cole152. B'51,301,'83,364. Wg72. Cult'54,249. AgR'54,293. E'54,379,'59,402. D'57,529,'69,825. A'62,70. T'75,255,'85,273,'97,455. Syn. of Osband.									
Osborn. Cole155. WHRN,205. AgR'54,263. E'54,379,'59,402. H179. Syn. of Osborne.									
Osborne. MagofH'46,338. B'51,318. D'57,529,'69,825. F274. T'75,552,'85,568,'97,710. Syn. Osborn.	Ind.	obtp	m	yg	j	v	g-p	me	Originated at Economy, Wayne County, Ind.
Osebano. FGAofO'72,10,11									In Transactions of Fruit Growers Association of Ontario, 1872, p. 11.
Osgood Summer. KanH'77,237									Possibly intended for Osband Summer.
Osimaya. Gb. Syn. of Winter									
Osmonville. R. Syn. President d'Osmonville									In the experimental orchard at Agassiz, B. C.
Oswego. E'54,380',59,402. AgR'54,293. Syns. Beurre Oswego, Oswego Beurre, Read's Seedling, Reed's Seedling, Reid's Seedling.	N. Y.	obo	m	yru	bjm	vp	g-vg	m	Raised by Walter Read, of Oswego, N. Y.
Oswego Beurre. Hort'47,324,535,'72,39. MagofH'47,198,450,'54,563. Cole169. B'51,307,'83,382. Wg72. Cult'48,21. E'54,380,'59,402. AgR'56,339. D'57,530,'69,825. H179. F252. CGenXX286. T'75,278,'85,296,'97,473. Syn. of Oswego.									
Oswego Incomparable. MagofH'60,504. D'69,826. PaFS'71,67. T'75,552,'85,568,'97,710. Syn. of Incomparable.									
Ott. Hort'49,432,'53,460,'62,486,'74,341. Wg73. MagofH'53,424. Cult'53,312,'58,372. MassH'53,21. E'54,379,'59,346. Hof. AgR'56,356. D'57,441,'69,826. F274. AJofHVIII,158. T'75,256,'85,274,97,455. BI227,231. B'83,383. AHM257.	Pa.	robo	s	gyru	m	sp	g-vg	me	A seedling of Seckel. Originated in Montgomery County, Pa.
Ott (Brinckle). MagofH'53,455. H179. Syn. Ott's Seedling	Pa.	robtp	s	gcru	j	s	g-vg	me	From seed of Ott. Originated by Dr. Brinckle.
Ott's Seedling. MagofH'48,424,'49,105,'53,455. B'51,301. D'69,826. Syn. of Ott (Brinckle).									
Oudinot. E'54,379,'59,402. T'97,710. Syn. of Andrews									
Ovin. L. Syns. Seraphine Ovin, Seraphine Ovyn	Belg.	robtp	m	yeru	mbj	sp	g	me	Originated in 1854.
Owen. Cole174. E'54,398,'59,423. F274. D'69,826	Mass.	rov	m	g	d	......	.....	ml	Originated by John Owen, Cambridge, Mass.
Oxford Chaumontel. GenF'33,196. D'45,433,'57,569,'69,718. E'54,359,'59,372. F279. Syn. of Chaumontel.									

Ozark. P'95,38. A'97,44. MoH'98,373,'02,66	Mo.	obl	l	gy	bg	sa	g	me	Originated in Polk County, Missouri, about 1845.
Paddington. C199. Pr77. K'32,142. GenF'37,278. E'54,389,'59,417. H180. F277. D'69,751. Syn. of Easter Bergamot.									
Paddock. D'57,530,'69,826. E'59,403.	Vt.	oblp	ms	yr	gm	s	g	e	Probable origin, Burlington, Vt.
Paddrington. D'45,429,'57,564. Syn. of Easter Bergamot									
Page. R. Syn. President de Page									Published in Transactions Massachusetts Horticultural Society, 1862, p. 32.
Paillean. F282. Syn. of Pailleau									
Pailleau. MagofH'42,58,'47,439. MassH'44,61. D'45,406,'69,826. A'54,239. E'54,398,'59,423. T'75,552,'85,568,'97,710. Syn. Paillean.	Belg.	t	m	gyru	j	s	g	me	
Paimpol. L. Syns. Beurre de Paimpol, Beurre Paimpol	Fr.	obtp	m	gyru	jm	s	g	me	
Pain et Vin. F282. Syns. Chaumontel Anglaise, Chene Vert, Chene Vin	For.								Not described.
Painter. R. Syn. Painter Seedling	Conn.								A seedling from West Haven, Conn.
Painter Seedling. MassH'65,44. A'67,158. Syn. of Painter.									
Pana. FGAofO'92,108. Syn. of Long									
Panachee. H180,199. Syn. of Long Green (Aut.)									
Panchresta. D'69,884. Syn. of Bon Chretien (Win.)									
Panisel. R. Syn. Fondante du Panisel									In the experimental orchard at Agassiz, B. C.
Panna. FGAofO'91,12. CanExFR'96,136. EFABC'00. Syns. Krasavka, Long Pear.	Eur.								Very hardy; from Moscow, Russia.
Paquency. D'45,404,'57,533,'69,830. Hort'47,447. E'54,334,'59,347. H180. F281. T'85,284,'97,710. Syn. of Payenche.									
Paques. T'97,710. Syn. of Easter Beurre.									
Parabelle Musque. D'69,734. Syn. of Louvain									
Paradise. Bul6,8. AHM257. Syns. Autumn Paradise, Calebasse, Calebasse Bosc, Calebasse Marianne, Calebasse Princesse Marianne, False Spreciew, Faux Spreciew, Marianne, Maria Nouvelle, Paradise d'Automne, Princesse Marianne.	Belg.	oblp	l	yeru	gjm	vp	vg	m	
Paradise d'Automne. K'41,150. D'45,402,'57,531,'69,827. MagofH'46,287,'54,139. Cole160. Wg73. Cult'51,210. HovI,57. B'51,307,'83,372. E'54,349,'59,345. AgR'56,366. Hort'55,231. F282. T'75,552,'85,568,'97,710. WnI,333,II,342. Syn. of Paradise.									
Pardee. F274. Syn. Pardee's Seedling	Conn.	r	s	yru	cogjm	vp	g-vg	m	Raised by S. D. Pardee, New Haven, Conn.
Pardee No. 2. D'57,489,'69,736. E'59,376. Syn. of Dickerman									
Pardee's Seedling. D'57,530,'69,872. GarM'71,214. T'75,552,'85,568,'97,710. Syn. of Pardee.									
Parent. L. Syn. Florimond Parent	Belg.	p	vl	gyru	comj	sp	g	me	Raised by Dr. John Van Mons.
Parfum d'Aout. Pr23. K'41,119. F282. D'69,828. Syn. of Perfume									
Parfum d'Hiver. MassH'46,151. F282. Syn. of Winter Perfume									
Parfum de Rose. D'69,828. Syn. of Rose Perfume									
Parigot. L. Syn. President Parigot	For.								Published by Field, p. 282.
Paris. L. Syns. Comte de Paris, Comte of Paris	Belg.	obtp	m	gyru	jm	svp	g-vg	me	Raised by Dr. John Van Mons.
Pariselle. D'69,733. Syn. of Hardenpont (Belg.)									
Parkinson's Warden. Pr117. Syn. of French Pound									
Parkinson's Warden. D'45,429,'57,567,'69,702. E'54,318,'59,333. F278. Syn. of Worcester.									
Parmentier. GenF'33,197. Cult'39,66. K'41,150. E'54,366,'59,380. H153. L18. Syn. of Dundas.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Parrot. EFABC'00									In the experimental orchard at Agassiz, B. C.
Parsonage. Hort'56,510,'57,114. A'56,198. MagofH'57,113. D'57,530,'69,828. F253. E'59,403. CGenIX,191. MeP'75,122. GaH'76,17. HEH&B'73. T'75,266,'85,284. '97,463.	N. Y.	obtp	ml	yeru	cogjm	v	g	me	Originated at New Rochelle, N. Y.
Parthenay. L. Syns. Bergamotte de Parthenay, Bergamotte Parthenay, Bergamotte Poireau, Bergamotte Stoffels, Beurre Parthenay, Parthenay, Poireau, Poire Poriault.	Fr.	oblp	l	yg	j	sa		vl	Only valued for cooking.
Pasovka. Gb. MHSC'82,60. A'83,74. FGAofO'83,223. IaH'85,382. IndH'85,27.	Rus.								Introduced into America in 1882.
Passans. L. Syns. Passans de Portugal, Passans du Portugal, Poire du Portugal, Poire Passans, Summer Portugal.		pt		gy	m			m	Cultivated at the Jardin des Plantes, Paris, France.
Passans da Portugal. A'75,68. Syn. of Portugal									
Passans de Portugal. GenF'33,197. MagofH'38,390,'42,60. Cult'39,66. A'54,239. Syn. of Passans.									
Passans du Portugal. K'41,133. AgR'54,249. Syn. of Passans									
Passans du Portugal. D'54,342,'57,532,'69,828. E'54,385,'59,403. AgR'56,345. F-282. IaH'77,387. T'85,267,'97,710. Syn. of Portugal.									
Passatutte. GenF'33,197. Cult'39,66. Syn. of Stevens									
Passa-tutti. D'69,859. Syn. of Stevens									
Passe Colmar. K'32,196,'41,164. GenF'33,197,'37,278. M'38,92,'44,81,'47,83. IndF-'40,183. Cult'39,66. D'45,444,'57,532,'69,829. Hort'46,21'49,410. MagofH'49,445. Cole172. B'51,310. Wg73. AgR'53,280. E'54,380,'59,403. H180. F254. A'62,70. T'75,289,'85,307. Syns. Ananas, Ananas d'Hiver, Bergentin, Beurre Chapman, Beurre Colmar dit Precel, Beurre Colmar Gris dite precel, Beurre d'Argenson, Cellite, Chapman's, Colmar Bonnet, Colmar d'Hiver, Colmar de Silly, Colmar Doree, Colmar Epineaux, Colmar Gris, Colmar Hardenpont, Colmar Preule, Colmar Reul, Colmar Souveraine, Colmar Van Mons, D'Ananas, Fondante de Mons, Fondante de Panisel, Gambier, Gift from Malines, Imperatrice, La Souverain, Marotte Sucre Jaune, Napoleon (of some American gardens), Passe Colmar dit Precele, Passe Colmar Epineaux, Passe Colmar Gris, Passe Colmar Gris dit Precel, Passe Colmar Nouveau, Passe Colmar Vineux, Pine Apple Pear, Poire d'Ananas, Poire Precel, Precel, Present de Malines, Preul, Preul's Colmar, Pucelle Condesienne, Regintin, Souveraine, Souveraine d'Hiver, Sovereign Colmar.	Belg.	obtp	ml	yru	bj	sv	g vg	l	Raised by Counsellor Hardenpont.
Passe Colmar (Belg.). L. Syn. Passe Colmar of Belgium	For.								Published by Field, p. 281.
Passe Colmar de Autumn. GenF'33,196. Syn. of White Doyenne									
Passe Colmar dit Precele. K'32,196. Syn. of Passe Colmar									
Passe Colmar Epineaux. Pr101. K'32,196,'41,164. GenF'33,197,'37,277. D'45,444,'57,532,'69,829. E'54,380,'59,403. F254. Syn. of Passe Colmar.									
Passe Colmar Francois. F281. D'69,791. Syn. of Witte									
Passe Colmar Gris. GenF'33,197. D'45,444,'57,532,'69,829. E'54,380,'59,403. F254. T'75,552,'85,568. Syn. of Passe Colmar.									
Passe Colmar Gris dit Precel. Pr101. GenF'33,197,'37,278. F281. Syn. of Passe Colmar.									

Passe Colmar Musque. F281. D'69,829. Syn. of Colmar Musque									
Passe Colmar Musque d'Automne. D'69,829. Syn. of Colmar Musque									
Passe Colmar Nouveau. F254,281. Syn. of Passe Colmar.									
Passe Colmar of Belgium. F281. Syn. of Passe Colmar (Belg.)									
Passe Colmar Vineux. Pr101. K'32,196. D'69,829. Syn. of Passe Colmar									
Passe Crassane. D'69,829. MassH'71,39. EFABC'00. WNYH'05,140. Syns. Neue Crassane, Surpasse Crassane.	Fr.	obtp	m	yru	gjm	v	g	l	
Passe Long. R. Syn. Passe Long Bras									Rejected by Congress of Fruit Growers, 1849.
Passe Long Bras. MagofH'50,296. A'54,239. Syn. of Passe Long									
Passe Madeleine. K'41,130. MagofH'43,131									In Kenrick's list of outcasts, 1841, p. 130.
Passe Tardive. MagofH'48,111,'57,157. B'51,318. D'69,829	Belg.	obop	m	yr	jm	s	g	vl	Raised by Maj. Esperen.
Pasteel. R. Syn. Bergamotte Pasteel									Published in Magazine of Horticulture, 1855, p. 146.
Pastor. EFABC'00. CanExFR'02,380		oblp	ml	y	jm	sp	g	l	In the experimental orchard at Agassiz, B. C.
Pastorale. Pr113. K'32,148,'41,122. MagofH'37,51,'43,131. Syns. Bagpipe of Autumn, Musette d'Automne, Pastourelle, Petit Rateau.	Fr.	p		gyr	m	p		ml	Very old; published by De la Quentinye and Evelyn.
Pastorale. NWFG'55,41. Syn. of Easter Beurre									
Pastorale de Christ. MagofH'43,131									Not described.
Pastorale d'Hiver. D'69,751. Syn. of Easter Beurre									
Pastourelle. Pr113. K'32,152. Syn. of Pastorale									
Pater Noster. MagofH'51,550,'56,229. D'57,532,'69,830. F274. A'62,109. AHortA'68,76. CGenXXV,94. T'75,290,'85,308,'97,481. Syns. Beurre Pater Nostre, Paul Thielens (erroneously), Paul Thiens.		obop	l	gyrru	jm	v	g-vg	m	In Dr. John Van Mons's catalogue in 1832; origin unknown.
Pater Noster. E'54,317,'59,331,403. H154. AgR'62,180. Syn. of Easter Beurre									
Pater Notte. K'41,159. Hov1,47. AgR'62,189. Syn. of Vicar									
Patroon. Hort'46,194									Exhibited at Buffalo, N. Y., Horticultural meeting, August, 1846.
Paul Ambre. F282. D'69,830. MichH'74,29. T'85,568,'97,710. E&B'94. AHM258.	Belg.	rov	m	gyeru	jbm	s	g-vg	m	
Paul Ambre. D'57,533. Syn. of Payenche									
Paul Thielen. E'54,380,'59,403. Syn. of Thielens									
Paul Thielens. D'69,830. T'75,553,'85,568,'97,711. Syn. of Thielens									
Paul Thielens (erroneously). D'69,830. Syn. of Pater Noster									
Paul Thiens. F282. Syn. of Pater Noster									
Payen. L. Syn. Beurre Payen	For.								Published by Field, p. 278; not described.
Payenche. D'69,830. T'75,552,'85,568,'97,711. Syns. De Perigord, Paquency, Paul Ambre, Payenchi de Perigord, Payenchi, Payency, Payuency, Poire de Payency, Poire de Perigord.	Belg.	oblp	m	yrru	comj	sp	g-vg	m	Discovered in the village of Payenche in 1830.
Payenchi. E'54,334,'59,347. D'69,830. Syn. of Payenche									
Payenchi de Perigord. E'54,334,'59,347. D'69,830. Syn. of Payenche									
Payency. Pr98,MagofH'48,57. E'54,334,'59,347. D'69,830. T'75,266,'85,284,'97,711. Syn. of Payenche.									
Paysans. MagofH'38,391									Not described.
Payuency. D'57,533. Syn. of Payenche									
P. Barry. Dap152. WNYH'82,18. A'81,23,'95,17,68. WnI,329,II,340,III,260. T'85,568,'97,711. JB'93. CNC'93. Syn. Barry.	Cal.	obtp	l	yru	djm	sv		l	Originated by B. S. Fox, San Jose, Cal.
Peach. D'69,831. Syns. Peach Pear, Pfirsichbirne, Poire Peche	Belg.	obop	m	gyru	jm	va	g	me	Raised by Maj. Esperen.
Peach Pear. D'57,533,'69,831. F281. E'59,403. T'75,553,'83,568,'97,711. Syn. of Peach.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Peacock. A'77,131	Utah?							ve	Recommended for its earliness in Utah.
Pear d'Albret. HovII,65. Syn. of Albret									
Pear d'Auch. Pr99. Syn. of Colmar									
Pearl Pear. Pr17. D'69,802. Syn. of Little Blanquet									
Pear of Austria. MagofH'44,64	Mass.?								Shown at meeting of Massachusetts Horticultural Society, 1844, by Mr. Warren, of Brighton.
Pear Royal. K'32,131. Syn. of Robine									
Pearson. R. Syn. Pearson Hunt's Pear									Cultivated by Silas Wharton in 1824.
Pearson Hunt's Pear. SW. Syn. of Pearson									
Peche. A'54,74	Pa							e	Reported by Dr. Eshleman to American Pomological Society, 1854.
Peck's Seedling. D'69,847. Syn. of Royal									
Peerless. BBCo									Not described in Brown Bros. catalogue, Rochester, N. Y.
Peffer. EFABC'00. Syns. Peffer's No. 3, Peffer's Seedling	Wis.?								In the Illinois Experiment Station trial lists.
Peffer's No. 1. CanExFR'96,136. [Probably never named and disseminated].									
Peffer's No. 2. CanExFR'96,136. EFABC'00. [Probably never named and disseminated.]									
Peffer's No. 3. Ind.H'86,82. WisH'89,176. NYC'90. IllH'96,187. Syn. of Peffer.									
Peffer's No. 7. CanExFR'96,136. EFABC'00. [Perhaps never named and disseminated.]									
Peffer's Seedling. IllH'90,117. Syn. of Peffer									
Pei-li. IaH'81,376. Syn. of Snow									
Peintre. L. Syns. Navez, Navez Peintre		ov	m	gybru	mj	s		me	Described by Hogg in the Fruit Manual.
Pelford. MagofH'43,389									Not described.
Pellssier. L. Syns. Marechal Pelissier, Marechal Pellissier	Fr	ov	m	yr				me	
Pemberton. AJofH11,262,111,192. AHortA'68,80. D'69,831. Syn. General Banks	Mass.	robt	m	ygr	dmj	p		me	Originated by Dr. S. A. Shurtleff, of Brookline, Mass.
Pendant. L. Syns. Hanging Pear, Knave's pear, Pendar, Pendard, Poire de Pendant.		t		ru	m	s		me	
Pendar. Pr84. Syn. of Pendant									
Pendard. MagofH'43,131. Syn. of Pendant									
Penderson. D'69,831	Conn.	r	m	gy	cojm	a	g	m	Raised by Samuel Penderson, New Haven, Conn.
Pendleton. E'54,380,'59,403. H181. Syn. Pendleton's Early York	Conn.	obtp	ms	yrru		sp	g	ve	Raised by Mrs. York, of Pendleton Hill, Conn.
Pendleton's Early York. MagofH'48,391. E'54,381,'59,403. D'57,533,'69,831. PaFS-'71,61. Hort'72,130. T'75,553,'85,568,'97,711. Syn. of Pendleton.									

Penfold. Hort'53,17. E'54,383,'59,347. AgR'62,191. Syn. of Sheldon									
Pengethly. K'32,197,'41,164. MagofH'43,128,'47,151. E'54,380,'59,403. D'57,533,'69,831. F281. T'75,553,'85,568,'97,711.	Eng.	ov	m	gyr	coj	s	g	vl	One of Dr. Thos. A. Knight's Seedlings.
Penn. Hort'63,58,355. D'69,831. A'99,15. Syns. Fraser or Butter Pear, Frazer, Railroad Fuss.	N. J.	rob	m	yru	cojm	sp	g-vg	m	Originated in Bordentown, N. J.
Penneo. Hort'72,130. Syn. of Pinneo									
Pennington. IaH'94,170. AHM242. Syn. Dupont	Iowa?								B. A. Mathews, of Iowa, considers it promising.
Pennsylvania. D'45,404,'57,579,'69,832. MagofH'47,255. B'51,308. E'54,380,'59,404. H181. F274. AJofHIX,86. Ia'74,204. T'75,553,'85,568,'97,711. Syn. Smith's Pennsylvania.	Pa.	robo	m	ybru	cojm	sp	p-g	me	Originated by J. B. Smith, of Philadelphia, Pa.
Pensionaire d'Hollande. MagofH'43,131. Syn. of Hollande									
Pentecote. R. Syn. Pentecote Hervy									Not described.
Pentecote Hervy. MagofH'55,146. Syn. of Pentecote									
Pepins. L. Syn. Saint Germain de Pepins	Eur.	robop	m	yeru	cog		g	vl	
Pequni. D'69,772. Syn. of Gilogil									
Pera de Coche. CalSBofH'92,49. Syn. of Hog									
Pera de San Juan. CalSBofH'92,49. Syn. of Joannet									
Peral del Campo. D'69,863. Syn. of Rose (Sum.)									
Perdreau. Pr20. K'32,127. D'45,343,'57,581,'69,846. E'54,394,'59,421. F282. Syn. of Early Rousselet.									
Perez. L. Syn. Abbe Perez	Ger.	ovob	sm	ygr	mj	vs		vl	Described by Leroy in 1862.
Perfume. L. Syns. August Perfume, Parfum d'Aout, Perfumed		p	s	yr	coj	p	g-p	me	Probably of little value.
Perfumed. Pr23. D'69,828. Syn. of Perfume									
Perfumed. Pf32. D'69,851. Syn. of Salviata									
Perpetual. D'69,832. IllH'96,209,'98,184,'00,253. T'97,711. Syn. of Beurre Perpetual, Princes Perpetual.	N. Y.	obtp	m	gyr	j			vl	Originated on Long Island. Will keep till May.
Perrault. R. Syn. Beurre Perrault									In the experimental orchard at Agassiz, B. C
Persick pear. Pr65. Syn. of Brest									
Petaless. Pr27. D'69,760. Syn. of Figue									
Peters. D'69,832. T'85,296	Mass.	robtp	m	gybr	cojm	s	g	me	Raised by A. Peters, Williamstown, Mass., in 1848.
Petersilie Peer. Pr212. D'69,760. Syn. of Flemish									
Petit Blanquet. Pr17. K'41,118. D'69,802. Syn. of Little Blanquet									
Petit Certeau. Pr64. D'69,668. Syn. of Brussels									
Petit Corail. D'57,500,'69,765. Syn. of Forelle									
Petite Beurre d'Hiver. Pr125. D'69,700. Syn. of Caissoy									
Petite Blanquette. Pr17. K'32,128. D'69,802. Syn. of Little Blanquet									
Petite Cassolette. Pr31. K'32,127. Syn. of Cassolette									
Petite Cuisse Madame. Cult'47,340									Not described.
Petite Epine d' Ete. Pr28. D'69,758. Syn. of Summer Thorn									
Petite Marguerite. AHortA'70,74. T'75,552,'85,568'97,711. Dap131. Mich'75,89,285. B'83,364. A'77,49. CanH'81,7,'97,361. AHM255. Syn. of Marguerite.									
Petit Johannet. D'69,658. Syn. of Joannet									
Petit Muscat. C177. Pr10. K'32,129,'41,117. M'38,64,'44,48,'57,56. D'45,340,'57,577,'69,802. A'54,239. AgR'54,263,'56,344. E'54,397,'49,422. Syn. of Little Muscat.									
Petit Muscat batard Muscade. D'69,775. Syn. of Chisel									
Petit Muscat d'Automne. D'69,841. Syn. of Red Bergamot									
Petit Musk. F261. Syn. of Little Muscat									
Petit Marque. D'69,704. Syn. of Bon Chretien Fondante									
Petit Oin. Pr106. K'32,147. Syn. of Merveille									
Petit Rateau. Pr113. K'32,148. Syn. of Pastorale									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Petit Rousselet. Pr20. K'32,131. GenF'37,277. D'45,343,'57,581,'69,846. E'54,399, '59,424. F282. T'75,553,'85,568,'97,711. Syn. of Rheims. .									
Petit St. Jean. Pr9. K'32,131,'41,117. Syn. of Harvest									
Petit St. Jean. Pr9. D'69,658. Syn. of Joannet									
Petre. K'32,197,'41,164. MagofH'37,437,'38,83,'47,437,'53,452. M'38,84,'44,71,'47,73. D'45,403,'57,533,'69,832. Hort'47,175,'50,253. Cole164. E'54,380,'59,404. MassH'47, 90. B'51,308. H180. F270. T'75,278,'85,296,'97,473. A'99,15.	Pa	obo	ml	ygru	bgm	p	g-vg	m	Originated in Bartram's Garden, Philadelphia, Pa.
Petalless. Pr27. D'69,760. Syn. of Figue									
Pfalzgrafin Kleine. EFABC'00. Syn. of Kleine									
Pflester. R. Syn. of Pfiester's Meadow									Shown at meeting of Cincinnati Horticultural Society in 1854.
Pfiester's Meadow. WHRIV,431. Syn. of Pfiester									
Pfirsichbirne. D'69,831. Syn. of Peach									
Pfundbirne. Gb. IaH'82,83. MHSC'82,60. FGAofO'83,223. Syn. of Pound									
Philadelphia. MagofH'54,461. Hort'54,493. A'54,185,'56,196. Cult'56,339. AgR-'56,405. D'57,534,'69,832. F274. GaH'77,21. T'75,278,'85,296,'97,473. Syns. Latch, Orange Bergamot (erroneously), Philadelphia Latch.	Pa	robtp	l	yru	cobjm	sp	g	me	Originated near Philadelphia, Pa.
Philadelphia Latch. E'54,404. Syn. of Philadelphia									
Philip Couvereur. FGAofO'83,72									Not described.
Philippe Delfosse. D'69,684. T'97,711. Syn. of Delfosse									
Philippe de Paques. GenF'33,198. K41,160. D'45,425,'57,428,'69,751. E'54,317,'59,331. F277. AgR'62,180. Syn. of Easter Beurre.									
Philippe Goes. D'57,535,'69,833. F282. E'59,404. PaFS'71,68. T'75,553,'85,568,'97 711. Syn. of Goes									
Philippot. R. Syn. Bergamot Philippot									In the experimental orchard at Agassiz, B. C.
Phillip Goes. Dap155. A'75,68. Syn. of Mello									
Philip Strie. D'69,859. Syn. of Stevens									
Phillips. MassH'48,101. MagofH'50,296. A'54,239. Syn. Phillips' Seedling	R. I								Originated at Newport, R. I.
Phillips' Seedling. WisH'75,67. Syn. of Phillips									
Philopena. AgR'89,444. A'91,124. IndH'98,100. YB'02,474. WNYH'04,24. Syn. Philopoena.	Ind	oblp	ms	yeru	jm	vs	vg-b	m	Originated with Reuben Ragan, Putnam County, Ind.
Philopoena. C(O)HS'91,20. Syn. of Philopena									
Picciola. D'69,833	Belg	rob	s	gyru	jm	v	g-vg	me	
Pickering. A'75,102. Syns. English Warden, Warden									Mr. Manning considered this distinct from Pound.
Pickering. K'32,151,'41,129. GenF'33,197. D'45,448. Syn. of Tonneau									
Pickering Pear. E'54,334,'59,346. D'57,537,'69,835. Syn. of Pound									
Pickering's Warden. D'69,835. Syn. of Pound									
Pickering's Warden. GenF'33,192. Syn. of Tonneau									
Picquery. D'69,871. Syn. of Urbaniste									
Picquet. R. Syn. Bergamot Picquet									Published by Magazine of Horticulture, 1852, p. 39.

Pie IX. MassH'53,21. MagofH'51,86. Hort'54,87. AgR'56,331. D'57,535,'69,833. Syns. Pio IX, Pius IX.	Belg	rp	ml	yru	jm	v	g-vg	m	Very variable in quality, says Mr. Downing.
Pierce. R. Syn. Pierce's Seedling									Not described.
Pierce's Seedling. MagofH'47,525. Syn. of Pierce									
Pierre. L. Syn. Besi de la Pierre, Bezi de la Pierre, Saint Pierre	Fr	ov	sm	y	dmj	v		m	Origin Auvergne, France; introduced in 1862.
Pierre Corneille. EFABC'00. Syn. of Corneille									
Pierre Joigneaux. EFABC'00. Syn. of Joigneaux									
Pierre Tourasse. EFABC'00. Syn. of Tourasse									
Pillsbury. IllH'96,204									In the trial collections at Illinois experiment stations.
Pinchart. L. Syn. Leonie Pinchart	Belg	robo	m	gyru	jm	s	vg	m	
Pine Apple Pear. Pr136. Syn. of Passe Colmar									
Pine Pear. GenF'33,196. D'45,378,'57,436,'69,880. HovII,85. E'54,322,'59,336. F224. AgR'62,183. Syn. of White Doyenne.									
Pinneo. Cult'45,304. MagofH'58,503. Hort'58,166 473,482,'59,170,'75,211. A'58,54,'62,70. D'69,833. AJofHVIII,159. HMH815. T'75,256,'85,274,'97,455. E'59,404. Syns. Boston, Early Denzelona, Graves, Hebron, Lebanon, Penneo, Summer Virgalieu, Virgalieu, Silliman's Russet.	Conn	robp	ms	yrru	djm	s	g	me	Origin claimed for Columbia, Tolland County, Conn.
Plusel. MagofH'43,151									Not described.
Pio IX. F282. Syn. of Pie IX									
Pionlice. D'69,704. Syn. of Bon Chretien Fondante									
Piper. E'54,334,'59,346. D'69,835. Syn. of Pound									
Piser. D'45,448. Syn. of Tonneau									
Piquot. L. Syn. Bergamotte Piquot		robtp	m	yrru	jm	sv	g	me	Not valuable; rots at core.
Pitolle Maroi. F281. Syn. of Jaminette									
Pistolette. Pr27. D'69,700. Syn. of Figue									
Pitford Pear. K'32,180. Syn. of Pitfour									
Pitfour. GenF'33,197. Cult'39,66. K'41,130. MagofH'43,131,'50,296. MassH'46, 151. A'54,239. Syn. Pitford.	Eng	obp	l	rur	m			ml	Brought to America in 1832.
Pitmaston. FESofO'02,12. CanH'03,129. AHM259. Syns. Pitmaston Duchess, Pitmaston Duchesse d'Angouleme.	Eng	obl	vl	yru	mbj			m	Raised by John Williams, of Pitmaston, England.
Pitmaston Duchess. AJofHVII,239. A'75,37,46,'77,50. T'75,553,'85,568,'97,711. B'83,373. AofH'91,296. EFABC'00. AHM259. Syn. of Pitmaston.									
Pitmaston Duchesse d'Angouleme. D'69,833. AgR'75,379. A'71,55. T'85,568. Wel,333,11342. CanH'03,129. Syn. of Pitmaston.									
Pitson. GarM'85,14									From Stone & Wellington, Toronto, Canada.
Pitt. L. Syns. Pitt's Marie Louise, Pitt's Prolific, Pitt's Prolific Marie, Pitt's Surpasse Marie, Surpass Marie Louise (incorrectly).	Eng	oblp	m	yru	eojd		p	me	
Pitt's Marie Louise. MassH'45,88. Cult'47,340. MagofH'50,296. A'54,239. E'54, 398. E'54,398,'59,423. Syn. of Pitt.									
Pitt's Prolific. MassH'44,66. D'45,404,'57,579,'69,834. Cult'47,340. A'54,238. E'54, 398,'59,423. Hist. F282. T'85,569,'97,711. Syn. of Pitt.									
Pitt's Prolific Marie. K'41,153. Syn. of Pitt									
Pitt's Surpasse Marie. D'45,404,'57,579,'69,834. Cult'47,340. E'54,398,'59,423. F282. Syn, of Pitt.									
Pius IX. WHRII,560. HEHB'73. E'59,404. T'75,553,'85,568,'97,711. B'83,383. Syn. of Pie IX.									
Plantagenet. D'69,834. AHortA'71,66. A'71,56.	Belg	p	m	gyru	jm		g-vg	ml	
Plascart. MassH'71,39		obo	m	yrb		v			Probably not desirable.
Platt. D'57,535,'69,834. F274. B'83,383. Syn. Platt's Seedling	N. Y.	rob	m	yru	jbm		g	m	Originated in Clinton County, N. Y.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Platt's Bergamot. K'41,130. MagofH'50,296,'59,150. A'54,239. Syn. of Bergamot (Platt).									
Platt's Bergamot (?). A'58,58. MagofH'59,150. Syn. of Church.									
Platt's Seedling. MagofH'50,545. D'57,535,'69,835. Syn. of Platt.									
Plessis. L. Syn. Belle du Plessis.	For.								Published by Field, p. 276; not described.
Plombgastel. MassH'45,88. MagofH'46,295. E'54,381,'59,410. H181. F282. T'85,285. D'69,851. Syn. of Archangel.									
Ploskui. R. Syn. Bergamotte Ploskui.									Published in Transactions of Iowa Horticultural Society, 1880, p. 61.
Plougastel. E'54,381,'59,410. Syn. of Archangel.									
Plumbgastel. MagofH'46,145. HovH,71. E'54,381,'59,410. Hort'68,202. T'75, 553,'85,569 '97,711. Syn. of Archangel.									
Plymouth. A'52,27. E'54,318,'59,334. AgR'62,182. Syn. of Boussock.									
Pocahontas. MagofH'47,525,'53,524,'59,474. Hort'54,85. A'54,155. D'57,535,'69, 834. F274. E'59,405. MassH'73,97. T'75,553,'85,569,'97,711.	Mass.	obop	ms	yeru	jm		g-vg	me	Originated at Quincy, Mass.
Poinsett. A'67,190	S. C.	obl	m	yb		v		me	Originated at Pomaria, S. C.; named for J. R. Poinsett.
Pointelle. L. Syn. Beurre Pointelle de Roux.	Belg.	obtp	m	gr	dmj	s	g	m	Described by Leroy.
Poire a deux tetes. Pr29. Syn. of Two Headed.									
Poire a deux yeux. Pr18. Syn. of Double Eye.									
Poire a Gobert. Pr97. D'45,436,'57,574,'69,772. E'54,395,'59,422. Syn. of Gilogil.									
Poire a la Perle. Pr17. K'32,128. F278. D'69,802. Syn. of Little Blanquet.									
Poire a la Reine. Pr11. K'32,130. GenF'33,197,'37,277. D'45,341,'57,578,'69,818. E'54,397,'59,423. F281. Syn. of Muscat Robert.									
Poire Ananas. D'45,349. E'54,339,'59,323. Syn. of Ananas d'Ete.									
Poire Ananas. D'57,507. F280. E'59,390. F280. Syn. of Henry IV.									
Poire Andouille. Hort'54,418									Very similar to Bosc; possibly the same.
Poire Angelique. Pr79. K'32,142. Syn. of Angelique.									
Poir d'Amiral. Pr66. Syn. of Admiral.									
Poireau. F277. D'69,671. Syn. of Parthenay.									
Poire aux Mouches. Pr42. K'32,130. D'69,825. Syn. of Orange Striped.									
Poire Benite. DomEncIV,187. Syn. of Blessed.									
Poire Braconot d'Epinal. D'69,707. Syn. of Braconot.									
Poire Briffaut. MagofH'55,317. Syn. of Briffaut.									
Poire Calesie. MassH'51,189.									Not described.
Poire Carafour. F278. Syn. of Van Marum.									
Poire Chenille. E'59,403. D'69,828. Syn. of Portugal.									
Poire Cire. MassH'51,189 CanH'94,291. Syn. of Vasschanka.									
Poire Dary. D'57,438,'69,760. F280. E'59,337. AgR'62,184. Syn. of Flemish.									
Poire d'Abondance. Pr37. K'41,120. Hort'53,31. E'54,381,'59,405. D'57,536,'69,656. F276. T'75,553,'85,569,'97,711. Syn. of Mon Dieu.									

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Poire d'Albert. H181. Syn. of Albret									
Poire d'Albret. MassH'51,189. HovII,65. MagofH'52,39,486,'53,106,202. E'54,381, '59,363,405. D'57,535,'69,678. F282. T'75,553,'85,569,'97,711. Syn. of Albret									
Poire d'Amboise. D'45,357,'57,471,'69,710. E'54,350. Syn. of Brown									
Poire d'Ambre. Pr11. K'32,130. GenF'37,277. MagofH'52,149. Syn. of Muscat Robert.									
Poire d'Amiral (of M. Hervey). K'32,191,'41,159. GenF'37,278. Syn. of Cardinale.									
Poire d'Amour. Pr117. D'69,659. Syn. of Amour									
Poire d'Amour. Pr117. Syn. of French Pound									
Poire d'Amour. Pr37. MagofH'37,14. D'45,383,'57,571. Syn. of Mon Dieu									
Poire d'Anana. GenF'37,278. Syn. Poire d'Ananas									Perhaps different from Passe Colmar.
Poire d'Ananas. Pr136. Syn. of Passe Colmar									
Poire d'Ananas. K'32,181,'41,150. GenF'37,278. Syn. of Poire d'Anana									
Poire d'Ange. Pr25. K'41,118. Syn. of Angel									
Poire d'Angleterre. Pr55. Syn. of Angleterre									
Poire d'Angoisse. Pr92. K'32,150,'41,125. GenF'37,278. D'69,884. Syn. of Bon Chretien (Win.)									
Poire d'Angora. K'41,155. MagofH,'43,50. Syn. of Pound									
Poire d'Apothecaire. D'69,884. Syn. of Bon Chretien (Win.)									
Poire d'Aremberg. K'32,188,'41,156. Gen.F'37,278. Syn. of Aremberg									
Poire d'Auch. Pr150. Syn. of Swan Egg									
Poire d'Austrasie. K'41,162. Syn. of Jaminette									
Poire d'Averat, Averat pear, Poire Royale, Royale Pear. Pr53. Syns. of Robine									
Poire d'Avril. MassH'53,17. MagofH'54,82. Hort'54,84. D'57,536,'69,664. E'59,405. T'75,553,'85,569,'97,711. Syn. of Avril.									
Poire de Bavay. D'57,486,'69,732. F279. E'59,376. Syn. of Bavay									
Poire de Berriays. D'69,672. Syn. of Berriays									
Poire de Boulogne. K'41,164. HovI,9. E'54,343,'59,413. Syn. of Le Clerc (Van Mons).									
Poire de Bunville. Pr63. D'69,844. Syn. of Ronville									
Poire de Cadet. D'45,367. E'54,354,'59,366. T'85,287. Syn. of Beauchamps									
Poire de Cadet. Pr76. E'54,354. D'69,670. Syn. of Cadet									
Poire de Cadette. K'32,133 Syn. of Cadet									
Poire de Cesar. Pr98. Syn. of Caesar									
Poire de Chaumontelle. Pr94. K'32 143. Syn. of Chaumontel									
Poire de Chypre. Pr20. K'32,127. D'45,343,'57,581,'69,846. E'54,394,'59,421. F282. Syn. of Early Rousselet.									
Poire de Colmar. Pr99. K'32,144,'41,125. Syn. of Colmar									
Poire de Cuisine. Pr98. Syn of Kitchen									
Poire de Cuisine de Verin. Pr98. Syn. of Kitchen									
Poire de [illegible] Pr212. Syn. of Flemish									
Poire de deux Soeurs. MagofH'55,186. Syn. of Sisters									
Poire de Duverny. K'41,150. Syn. of Devergnies									
Poire d'Eau rose. Pr8. Syn. of Rose (Sum.)									
Poire de Fer. [illegible]'71,30									This may be Worcester; synonym Iron Pear.
Poire de Glace. K'32,149,'41,124. D'69,877. Syn. of Virgouleuse									
Poire de Glace of Gascony. Pr87. Syn. of Virgouleuse									
Poire de Bahu. Pr27 Syn of Sanguinole									
Poire de Jardin. Pr105. K'41,121. Syn. of Jardin									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Poire de Jersey. HovI,39. AgR'62,185. Syn. of Louise									
Poire de Lepine. D'57,536,'69,801. F282. T'75,553,'85,569,'97,712. Syn of Lepine.									
Poire delices de Froyennes. MagofH'55,189. Syn. of Froyennes									
Poire de Limon. Pr43. GenF'33,196. F224,279. HovII85. AgR'62,183. D'69, 880. Syn. of White Doyenne.									
Poire de Livre. Pr117. Syn. of French Pound									
Poire de Louvain. Pr205. K'32,182,'41,150. D'45,383,'57,486,'69,734. Cult'47,340. E'54,361,'59,375. F279. Syn. of Louvain.									
Poire de Malthe. Pr38. Syn. of Rose (Sum.)									
Poire de M. Bonnet. Cult'47,340									Not described.
Poire de Melon. K'32,189,'41,156. GenF'37,278. Syn. of Diel									
Poire de Mons. K'41,150. MassH'51,189. MagofH'52,39			m					ml	
Poire de Mons. HovI,13. Syn. of Spoelberch									
Poire de Naples. Pr78. K'41,125. Syn. of Lent									
Poire d'Œuf. Pr26. K'41,119. Syn. of Swan Egg									
Poire d'Ognon. Pr38. Syn. of Rose (Sum.)									
Poire d'Oignon. Pr24. Syn. of Archduke									
Poire de Payency. Pr98. MagofH'48,57. E'54,334,'59,347. D'69,830. Syn. of Payenche.									
Poire de Pendant. Pr84. Syn. of Pendant									
Poire de Perigord. Pr98. E'54,334,'59,347. Syn. of Payenche									
Poire de Persil. Pr212. D'69,760. Syn. of Flemish									
Poire de Pese. Pr114. Syn. of Augustin									
Poire de Preter. K'41,125. Syn. of Preter									
Poire de Pretre. Pr108. Syn. of Priest									
Poire de Prince. K'32,130. D'69,837. Syn. of Prince									
Poire de Prince. Pr35. Syn. of The Prince									
Poire de Printemps. D'57,544,'69,858. F282. E'59,409. Syn. of Sovereign (Spring)									
Poire doree. Pr12. Syn. of Aurate									
Poire de Rose. Pr38. K'32,132. D'45,345,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Rose (Sum.).									
Poire de Saint Pere. K'32,148,'41,126. Syn. of Saint Pere									
Poire des Bois. Pr212. Syn. of Flemish									
Poire des Champs des Charireux. Pr37. Syn. of Chartreux									
Poire des Chartreux. Pr37. Syn. of Chartreux									
Poire des Chasseurs. MagofH'53,40. D'57,536,'69,735. F279,282. T'75,553,'85,569, '97,712. Syn. of Chasseurs.									
Poire des Deux Soeurs. E'59,405	For	oblp	l	g	j	s	......	ml	Description from Elliott, 1859, p. 405.
Poire de Seigneur. Pr43. GenF'33,196. D'45,378,'57,436. HovII,85. F224. AgR'62,183. Syn. of White Doyenne.									
Poire des Eparaznais. HAJ'89,37. Syn. of Angouleme.									
Poire de Sillerie. GenF'37,277. Syn. of Cassolette									

Poire de Simon (of the French). D'45,378,'57,436. Syn. of White Doyenne.
Poire des Invalides. D'69,725. Syn. of Invalides.
Poire de 16 Ounces. D'69,772. Syn. of Gilogil.
Poire Des Nonnes. D'57,470,'69,681. F277. E'59,376. Syn. of Brignais.
Poire des Princes. E'59,421. Syn. of Jargonelle (Fr.).
Poire de Stuttgard. D'69,847. Syn. of Stuttgart.
Poire Des Trois Jours. K'41,149. Syn. of Trois Jours.
Poire de Tables des Princes. Pr152. GenF'37,277. D'45,337,'57,514,'69,758. E'54,373,'59,383. F280. Syn. of Jargonelle (Eng.).
Poire de Tongres. MagofH'54,457,'55,189,'57,502. E'59,405. Syn. of Tongres.
Poire de Tonneau. K'32,151,'41,129. Syn. of Tonneau.
Poire d'Une Livre. K'41,124. Syn. of Livre.
Poire Deux Soeurs. MagofH'54,460. Hort'54,420. Syn. of Sisters.
Poire de Vigne. Pr58. Syn. of Vigne.
Poire Douce. Pr79. Syn. of Angelique.
Poire du Congres Pomologique. GarM'72,250. Syn. of Souvenir.
Poire du Doyen. D'69,880. Syn. of White Doyenne.
Poire du Jardin. C195. H181. D'69,770. Syn. of Garden.
Poire du Portugal. Pr91. Syn. of Passans.
Poire Durandeau. MagofH'57,502. D'57,488,'69,735. T'85,560. Syn. of Tongres.
Poire du Rousselet. Pr21. Syn. of Summer King.
Poire du Vitrier. K'32,139,'41,123. Syn. of Vitrier.
Poire Episcopal. K'41,169. Not described.
Poire Faurite. MagofH'48,111. Syn. of Faurite.
Poire Figue. Pr26. Syn. of Beauty (Sum.).
Poire Figue. Pr27. Syn. of Figue.
Poire Gendron. D'69,688. Syn. of Gendron.
Poire Gerando. MassH'51,189. MagofH'52,39. D'69,771. Syn. of Gerando.
Poire Giffard. D'69,689. Syn. of Giffard.
Poire glace. GenF'33,197. D'45,150,'57,584,'69,877. E'51,400,'59,425. F283. Syn. of Virgouleuse.
Poire Goubalt. D'69,690. Syn. of Goubalt.
Poire Guillaume. E'54,311,'59,324. AgR'62,179. T'75,553,'85,569,'97,712. Syn. of Bartlett.
Poire Guillaume (of the French). D'45,334,'57,421,'69,666. Hort'53,350. F276. Syn. of Bartlett.
Poire hativecea or hativeau. Pr13. Syn. of Madeleine.
Poire [illegible]. E'59,377. Syn. of Mello.
Poire [illegible]. MassH'51,189. MagofH'52,39,'53,104. AJofH VIII.222. D'69,850. Syn. of Menin.
Poire Liard. D'57,526,'69,819. F249. Syn. of Napoleon.
Poire Livre. CanH'94,293. Not described.
Poire Louvain. MagofH'55,185. Syn. of Louvain.
Poire Manne. Pr99. K'32,144,'41,125. GenF'37,278. Syn. of Colmar.
Poire Miel. CanH'94,292. Syn. of Medofka.
Poire Monsieur. Pr43. D'45,378,'57,436. F224. AgR'62,183. Syn. of White Doyenne.
Poire Monsieur le Curé. K'41,179. Syn. of Vicar.
Poire Napoleon. D'69,819. Syn. of Napoleon.
Poire Neige. GenF'33,196. D'45,378,'57,436. HovH.85. AgR'62,183. T'75,563,'85,569,'97,712. Syn. of White Doyenne.
Poire Neill. K'32,182,'41,150. Cult'47,340. MassH'51,189. MagofH'52,151. E'51,398. Syn. of Niell.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Poire Niell. E'59,330. Syn. of Anjou									
Poire Niell. Pr205. D'45,401,'57,526,'69,821. MagofH'54,136. F281. Syn. of Niell									
Poire Passans. Pr91. Syn of Passans									
Poire Peche. MagofH'52,300. W.H.R.H.560. Hort'57,473. D'57,533,'69,831. F282. Syn. of Peach.									
Poire Pomme. Pr99. D'69,662. L14. Syn. of Apple									
Poire Poriault. D'69,671. Syn. of Parthenay									
Poire Precel. Pr101. K'32,196. GenF'37,278. Syn. of Passe Colmar									
Poire Prevost. MagofH'57,159. D'57,537,'69,836. F282. E'59,405. Syn. of Prevost									
Poire Prince Albert. MagofH'54,459,'55,189. Hort'54,419. E'59,363. Syn of Albert									
Poire Rameau. D'57,566. E'59,405. Syn. of Veterans									
Poire Ridelle. MassH'51,189. MagofH'52,39. Syn. of Ridelle									
Poire Rigoleau. MagofH'52,474,'54,136. Syn. of Rigoleau									
Poire Ritelle. D'57,540,'69,842. F282. E'59,407. Syn. of Ridelle									
Poire Rousseline. Pr90. Syn. of Rousseline									
Poire Roussilon. MagofH'57,302. D'57,536. Syn. of Rousseline									
Poire St. Andre. E'54,338,'59,350. Syn. of Saint Andre									
Poire St. Menin. MagofH'56,231. E'59,410. Syn. of Menin									
Poire Sans Peau. Pr138. K'32,131,'41,119. D'45,345,'57,542,'69,856. E'54,383,'59,350. F282. Syn. of Skinless.									
Poire Sans Pepins. K'32,182. D'69,778. Syn. of Hampden									
Poire Seigneur. MagofH'52,150									Not described.
Poire Serrurier. MassH'51,189. Syn. of Serrurier									
Poire Seutin. D'69,854. Syn. of Seutin									
Poire Seutin. D'57,554. Syn. of Vauquelin									
Poire Six. D'69,697. Syn. of Six									
Poire Tresor d'Amour. K'41,124. Syn. of Amour									
Poire Truite. Pr130. K'32,173. GenF'33,196. D'45,389,'57,500,'69,765. E'54,368,'59,383. L16. Syn. of Forelle.									
Poire Tulipee. Pr42. Syn. of Orange Striped									
Poire Tulipee. Pr38. Syn. of Rose (Sum.)									
Poire Turque. Pr41. Syn. of Bon Chrietien (Fl.)									
Poire Van Marum. D'69,873. Syn. of Van Marum									
Poire Vauquelin. D'57,554,'69,874. Syn. of Vauquelin									
Poiteau. L. Syns. Choice d'un Amateur, Choice of an Amateur, Choix d'un Amateur, New Pear, Nouveau Poiteau, Noveau Poiteau, Retour de Rome, Tombe de l'Amateur.	Belg	obop	l	gru	bjm	sv	g-vg	m	Raised by Dr. John Van Mons, of Louvain.
Poitevin. L. Syns. Lieutenant Poidevin, Lieutenant Poitevin	Fr	obtp	l	yeru	jbeo			vl	Introduced in 1853.
Poke. MagofH'43,128									Probably intended for "Polk."
Polish Lemon. Gb. Syn. Cytrymova	Rus.?								Brought to America in 1882.
Polk. MagofH'45,252,437. Cult'45,175. Syn. James K. Polk	Conn								Originated by Governor Edwards, of Connecticut.
Pollan. D'69,834	Pa	r	ms	gyb	coj	v	g	me	

Pollockshaw. MagofH'43,131									Not described.
Pollvaskaja. IaH'80,61	Rus.?								Not described.
Poltava. Gb. Syn. Poltavskaya	Rus.?								Not described.
Poltavskaya. Gb. Syn. of Poltava									
Pomerania. Gb. Syn. Pomeranzenbirne	Rus.?								Brought to America in 1882.
Pomeranovka. CanExFR'96,136									In the experimental orchard at Agassiz, B. C.
Pomeranzenbirne. Gb. Syn. of Pomerania									
Pomme. F282. Syn. Pomme Poire	For								In Field's undescribed list.
Pomme Poire. K'41,149. A'54,239. Syn. of Pomme									
Pomone. M'47,96. D'69,662. Syn. of Apple									
Pomologie. L. Syns. Congress Pomologique, Triomphe de la Pomologie, Triomphe de Pomologique.	Fr	obtp	m	gy	bjm	s	g-vg	m	Originated at Rouen, France, in 1856.
Pond. R. Syn. Pond Lily									Published by Magazine of Horticulture, 1839, p. 37; not described.
Pond Lily. MagofH'39,37. Syn. of Pond									
Pope. A'69,51,'73,119. Syn. of Bonners									
Pope's Quaker. MagofH'36,456,'37,15. M'38,82,'44,69. MassH'44,59. E'54,398,'59,423. A'54,239. H182. D'57,580,'69,834. F274. T'75,553,'85,569,'97,712. Syn. of Quaker.									
Pope Russet. R. Syn. Pope's Russet									Exhibited by Robert Manning in 1844.
Pope's Russet. MagofH'42,33. MassH'44,60. A'54,239. Syn. of Pope Russet.									
Pope's Scarlet Major. MagofH'37,15. MassH'37,37. D'45,406,'57,580,69,'834. E'54,398,'59,423. A'54,239. H181. F274. Syn. of Major.									
Porter. MassH'66,44	Mass.								Originated by Dr. S. A. Shurtleff at Brookline, Mass.
Portugal. L. Syns. Bergamotte, Butter (of Michigan), Chenille, Dazalonia, Early Bergamot (of Wisconsin), Miller's Early, Passans da Portugal, Passans du Portugal, Poire Chenille, Summer Portugal.		robl	s	ybr	jbd		g	me	
Posey. F'95,58. A'97,44	Ind.?	p	m	y	b	sa	g-vg	m	Found on farm of J. Grabel, Franklin County, Ind., in 1880.
Potts. D'69,773. Syn. of Glout Morceau									
Pottstown. HB&T	Pa							m	In the catalogue of Hoopes Bros. & Thomas.
Pouchet. Dap155. Syn. of Ananas									
Pound. DomEncIV,188. GarCal587. C209. Th188. Pr149. K'32,151,'41,129. M'38,96,'44,86,'47,91. SW. IndF'40,105. D'45,445,'57,537,'69,835, Cole 174. E'54,234,'59,346. H120. F283. T'75,290,'85,308,'97,481. WnI,328. Syns. Abbe Mongein, Anderson, Angora, Beute de Tervueren, Beauty of Turvensen, Belle Angevine, Belle de Jersey, Bellissime d'Hives du Bur, Berthebirn, Bolivar, Bolivar d'Hiver, Bretagne le Cour, Chamber's Large, Comice de Toulon, Comtesse de Terweuren, Cordelier, D'Horticulture, Dr. Udale's Warden, Duchesse de Berry, Duchesse de Berry d'Hiver, DuTonneau, English Bell, Faux Bolivar, Funtovka, German Baker, Gros fin or long d'Hiver, Grosse Dame Jeanne, Grosse de Bruxelles, La Quintyne, Large Cordelier, Lent St. Germain, Louise Bonne d'Hiver, Pfundbirne, Pickering Pear, Pickering Warden, Piper, Poirie Angora, Royal d'Angleterre, Union, Uvedale's St. Germain, Uvedale's Warden, Winter Bell.		p	vl	gyb	co			l	Only valued for cooking.
Pound, Moon's. H182. Syn. of Moon									
Pound Pear. K'32,151,'41,128. MHSC'76,32. Syn. of Catillac									
Pound Pear. Pr117. Syn. of French Pound									
Powell's Virgalieu. D'69,864. Syn. of Virgalieu (Sum.)									

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Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Powis. R. Syn. Powis Castle									Not described.
Powis Castle. Mag of H'43,128. Syn. of Powis									
Pradello de Catalogue. D'69,875. Syn. of Vicar									
Prairie. L. Syns. Prairie du Pond, Prairie du Pont	Ohio	r	s	gyb	jm	va	p	me	Introduced by A. H. Ernst, of Cincinnati, Ohio.
Prairie du Pond. IllH'68,311. D'69,835. EFABC'00. Syn. of Prairie									
Prairie du Pont. IllH'96,178. BBL. CanExFR'96,136. Syn. of Prairie									
Pratique de Rouen. D'69,687. Syn. of Cercle									
Pratt. Hort'46,210,'47,431. MagofH'47,449,515,'51,258. Cole157. B'51 307,'83,373. Wg73. AgR'54,263,'56,330. E'54,381,'59,405. D'57,537,'69,835. F274. A'62,70. AHortA'69,79. T'75,266,'85,284,'97,464. IaH'94,170. Bul6.	R. I.	obtp	m	gyeru	jm	vs	g-vg	me	Said to have originated in Johnson; R. I.
Pratt Jr. A'62,151	R. I.								Origin on the same farm as Pratt. Named by Rhode Island Horticultural Society.
Preble. L. T'97,473. Syn. Beurre Preble	Me.	obl	m	gyru	bm	v	g	m	Named by Mr. Manning for Commodore Edward Preble.
Preble's Beurre. K'32,180,'41,153. Syn. of Franc Real (Sum.)									
Precel. GenF'33,197. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.									
Precilly. D'69,835	Belg.	obop	ml	gyru	cojbr			m	A cooking pear.
Precoce de Glady. D'69,856. Syn. of Skinless									
Precoce de Trevoux. EFABC'00. Syn. of Trevoux									
Precocee. L. T'97,712. Syn. Beurre Precocee, Bezi Precocee, Precocee Goubault.	Fr.	obop	m	gyru	jm	va	g	me	Raised by M. Goubault, of Angers, France.
Precoce Goubault. D'69,695. A'69,88. Syn. of Precocee									
Premature. K'32,157. GenF'37,277			s				g	ve	Popular in the markets of Edinburgh, Scotland.
Premices d'Ecully. Dap132. EFABC'00. Syn. of Ecully									
Premices de Maria Lesueur. EFABC'00. Syn. of Maria Lesueur									
Premices de Wagelwater. D'69,836. Syn. of Wagelwater									
Premier. R. Syn. Leopold Premier	Belg.						vg		Originated by Dr. John Van Mons; fruited in 1848.
Prende du Pont. IllH'77,228									Dr. Pennington, of Illinois, said it was poor, but valuable with him.
Present de Malines. Fr135. K'32,197. GenF'33,197. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.									
Present Royal de Nantes. E'54,354. D'69,667. Syn. of Artois									
Present Royal de Naples. MagofH'38,395. E'54,354. F276. D'69,667. Syn. of Artois.									
President. MassH'65,44,'66,44,'77,79. A'67,156,'69,46,100,'77,104,'81,99. AJofHIII, 6,192. AHortA'69,80. D'69,836. AHM260.	Mass.	robo	vl	gyru	coj	v	g	ml	Raised by Dr. Shurtleff, Brookline, Mass. Described in New England Farmer, 1862.

President Carnot. EFABC'00. Syn. of Carnot									
President Clark. STM. MassH'80,235,'82,33,34,'86,25. A'81,97									Probably distinct from Clark of Magazine of Horticulture, 1853, p. 518.
President Couprie. IaH'79,326. Syn. of Couprie									
President d'Espagne. D'69,858. Syn. of Spanish									
President de la Bastie. EFABC'00. Syn. of Bastie									
President d'Osmonville. EFABC'00. Syn. of Osmonville									
President Dr. Ward. NJH'05,157. Syn. of President Ward									
President Drouard (of C.A. Green). A of H'89,151. Bul8. EFABC'00. HB'03,137. AHM241. Syn. of Drouard.									
President Felton. D'69,835. A'99,15. Syn. of Felton									
President Fortier. EFABC'00. Syn. of Fortier									
President Gilbert. E&B'94. EFABC'00. WNYH'05,140. Syn. of Gilbert									
President Heron. EFABC'00. CanExFR'05,430. Syn. of Heron									
President Mas. AJofHIX,29. D'69,836. B'83,383. T'85,569,'97,712. JBWMB'92. EFABC'00. AHM266. Syn. of Mas (Pres.).									
President Parigot. F282. Syn. of Parigot									
President Ward. R. Syn. President Dr. Ward	N. J.?								Published in Transactions of New Jersey Horticultural Society, 1905, p. 157.
Preter. L. Syns. De Pretre, Poire de Preter									Published in Magazine of Horticulture, 1843, p. 131.
Prettiman. AgR'55,296									Not described.
Preul. D'69,829. Syn. of Passe Colmar									
Preul's Colmar. Pr101. Syn. of Passe Colmar									
Prevost. MagofH'54,138. WHRII,560. Hort'55,70. D'57,537,'69,836. F282. E'59,405. T'75,553,'85,569,'97,712. AofH'91,296. IHH'93,106. CanExFR'00,463. WNYH'05,140. Syn. Prevost.	Belg	obop	m	yr	cojb	s	g	vl	
Priest. L. Syns. Poire de Pretre, Priests's Pear				g	b	a		vl	Old and probably valueless.
Priest's Pear. Pr108. Syn. of Priest		r							
Primitiee. C177. Pr10. K'32,129. D'45,340,'57,577,'69,802. E'54,397,'59,422. F281. T'75,550,'85,565,'97,707. Syn. of Little Muscat.									
Primm. BBL									In Benjamin Buckman's trial orchard, Farmingdale, Ill.
Primrose. AgR'75,380. Syn. of Springfield									
Prince. R. Syns. Chair a Dame, Cher Adame, Lady flesh, Poire de Prince, Prince's Pear.		rp	s	gyru	coj	s		me	Old and of unknown origin.
Prince Albert. MagofH'57,303. D'57,537,'69,836. F282. E'59,406. T'75,553,'85,569,'97,712. Syn. of Albert.									
Prince's Bergamot. GarCal587. Syn. of Prince									
Prince Camille de Rohan. D'69,714. Syn. of Rohan									
Prince Consort. WNYH'89,159									Published in Transactions of Western New York Horticultural Society, 1889, p. 159.
Prince de Joinville. D'69,837. Syn. of Joinville									
Prince d'Orange. MagofH'55,146									Not described.
Prince du Printemps. K'32,198. L18. Syn. of Printemps									
Prince Frederick. MagofH'43,131. Syn. of Frederick									
Prince's Green Sugar. E'54,396,'59,422. Syn. of Green Sweet									
Prince's Harvest. D'69,837. Syn. of Harvest (Prince)									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Prince Imperial. F282. EFABC'00. CanExFR'04,480	For	p	m	yru	b	s	vg	m	In the experimental orchard at Agassiz, B. C.
Prince Imperial de France. D'69,837. Syn. of Gregoire									
Prince Napoleon. D'69,837. WNYH'96,26. EFABC'00. Syn. of Napoleon (Prince).									
Prince's Pear. Th188. K'32,130,'41,119. D'69,837. Syn. of Prince									
Prince of Wales. AofH'92,202. Syn. of Wales									
Prince's Perpetual. F274. Syn. of Perpetual									
Prince Portugal. R. Syn. Prince's Portugal									Rejected by Congress of Fruit Growers, 1849.
Prince's Portugal. MagofH'50,296. A'54,239. Syn. of Prince Portugal									
Prince Rudolph (of Austria). EFABC'00. Syn. of Rudolph									
Prince's St. Germain. WPr10. Pr146. K'32,181,'41,151. M'38,93,'44,80,'47,82. IndF'40,183. D'45,447,'57,548,'69,837. Cole170. AgR'50,95,'56,368. B'51,310. Wg73. E'54,335,'59,348. H182. F271. Hort'63,311. T'85,311,'97,484. Syn. of Germain (Prince).									
Prince's Sugar. K'32,139,'41,127. MagofH'37,14. D'45,344,'57,582,'69,862. A'79,84. Syn. of Sugar Top.									
Prince's Sugar Top. D'45,344,'57,582,'69,862. E'54,399,'59,424. F274. Syn. of Sugar Top.									
Princess. Gb. FGAofO'92,109. WNYH'93,44. CanH'94,292. Syns. Beurre Romain, Princessbirne, Red Panna.	Rus.?			y	g	s	g		Brought from Europe in 1882.
Princessbirne. Gb. Syn. of Princess									
Princess Charlotte. D'57,580,'69,838. F282. T'75,554,'85,569,'97,712. Syn. of Charlotte (Princess).									
Princess Conquette. K'41,151, F282. Syn. of Orange (Princess)									
Princesse Charlotte. MagofH'55,188. Syn. of Charlotte (Princess)									
Princesse Couquete. D'45,405,'57,580,'69,839. E'54,398,'59,423. Syn. of Orange (Princess).									
Princesse d'Orange. Pr127. K'32,181,'41,170. GenF'37,277. MagofH'42,250. D'45,405,'57,580,'69,839. E'54,398,'59,423. Syn. of Orange (Princess).									
Princesse d'Parme. K'41,148. D'45,399,'57,522,'69,813. HovII,37. E'54,377,'59,398. F281. Syn. of Marie Louise.									
Princess Helen d'Orleans. F282. D'69,749. Syn. of Helene									
Princess Maria. D'57,580,'64,838. T'75,554,'85,569,'97,712. Syn. of Maria (Princess).									
Princess Marie. F282. AJofHVIII,228. Syn. of Maria (Princess)									
Princesse Marianne. MassH'51,189. MagofH'52,39,'53,107. D'57,531,'69,827. F254,282. Syn. of Paradise.									
Princess of Orange. Pr127. GenF'37,277. M'38,83,'44,68,'47,71. D'45,405,'57,580,'69,839. A'54,239. E'54,398,'59,423. H182. F282. MagofH'56,262. T'75,554,'85,569,'97,712. Syn. of Orange (Princess).									
Princess of Wales. AJofHII,37. Syn. of Huyshe Princess									
Princess (Rivers). CanExFR'96,446		oblp	ml	yru	jm	v		m	In the experimental orchards at Agassiz, B. C

Princess Royal. MagofH'41,286. K'41,165. E'54,381,'59,406. D'69,776. FGAofO'92,97. Syn. of Groom.									
Prince Table. R. Syns. Long Green Summer Pear, Prince's Table Pear		oblp		y				me	Published in the Domestic Encyclopedia, 1804. Probably Long Green of Downing.
Prince's Table Pear. DomEncIV,182. Syn. of Prince Table									
Première de Kopertsh. D'69,796. Syn. of Kopertscher									
Prindle. E'59,411. Syn. of Thorp									
Printemps. L. Syn. Prince du Printemps	Fl	t	s	g	b	s	g	vl	Procured by Mr. Braddick from M. Stoffels in 1819.
Prinz Napoleon. AofH'91,296. Syn. of Napoleon (Prince)									
Prodil. F282	For.								Not described.
Professor Delaville. EFABC'00. Syn. of Delaville									
Professor Dubreuil. F282. Syn. of Dubreuil									
Professeur Hennau. D'69,839. Syn. of Hennau									
Professor Hortales. Dap132. Syn. of Hortales									
Provence. Pr85. Syns. Bequesne, Donville (of some collections)		p		yru	b	p			
Provence (Ogn.). L. Syns. Ognonet de Provence, Ognonet of Provence	Fr.	t	s	gyrru	co	p		me	
Providence. A'52,27. E'54,318,'59,334. Syn. of Boussock									
Provost. R. Syn. Bon Chretien Provost									Published in Transactions of Iowa Horticultural Society, 1879, p. 325.
Pucelle Condesienne. D'57,532,'69,829. F281. Syn. of Passe Colmar									
Pucelle de Saintonge. Pr89. Cult'47,340. Syn. of Chat Brusle									
Pucelle de Saintonge. K'32,130. Syn. of Muscat Robert									
Pucelle de Xaintonge. Pr11. Syn. of Muscat Robert									
Pucelle de Xaintonge (erroneously). Pr89. Syn. of Chat Brusle									
Pudsey. A'75,97	N. S.								A native of Nova Scotia.
Puebla. Dap152. FGAofO'73,7,82	Fr.	robtp	l	gy	cobj	v		m	Originated by Andre Leroy, of Angers, France.
Pulsifer. PF'53,417. Hort'53,460. E'54,381,'59,406. D'57,538,'69,839. Cult'58,372. H182. F274. PaSF'71,64. Syn. Pulsiver.	Ill	obop	s	yeru	cojm	v	g	me	Originated by Dr. Pennington, Hennepin, Ill., in 1843.
Pulsiver. Hort'72,150. Syn. of Pulsifer									
Punctierter. R. Syn. Punctierter Sommerdorn					m		vg	m	
Punctierter Sommerdorn. MoH'87,259. Syn. of Punctierter									
Punderson. MagofH'38,231,466									Exhibited by Dr. Ives at meeting of New Haven (Conn.) Horticultural Society, 1838.
Puvis. L. Syns. Puvis St. Germain, Saint Germain Puvis	Fr.	oblp	l	gyru	dmj	vs		me	But little known in America.
Puvis St. Germain. D'69,839. Syn. of Puvis									
Pyrenees. L. Syns. Tarquin, Tarquin de Pyrenees, Tarquin des Pyrenees		p	l	gru			p	vl	Said to keep for two years.
Pyrus Brandeum. Pr211. Syn. of Brande									
Pyrus Innominata. Pr213. Syn. of Innominee									
Pysans. R. Syn. Pysans de Portugal									Not described.
Pysans de Portugal. MagofH'39,391. Syn. of Pysans									
Quaker. K'41,139. Syn. Pope's Quaker	N. Y.	oblp	m	yru	jm		g-p	m	Originated on Long Island, N. Y.
Quarante Onces. Pr118. Syn. of Catillac									
Queen. Pr11. EFABC'00. Syn. of Muscat Robert									
Queen's Amber. D'69,818. Syn. of Muscat Robert									
Queen Caroline. MagofH'33,436. MassH'44,59. D'45,408. A'54,239. E'54,398,'59,423. Syn. of Caroline.									
Queen of August. F274. A'58,55. D'69,784. Syn. of Hosenschenck									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Queen of Netherlands. F282. Syn. of Low Countries									
Queen of Pears. M'47,93. E'54,398,'59,423. L18. Syn. of Queen Pear									
Queen of the Low Countries. K'41,151. MagofH'42,59. D'45,406,'57,580,'69,839. Cole167. B'51,318. A'54,239. E'54,382,'59,466. H183. F282. T'75,266,'85,284, '97,464. Syn. of Low Countries.									
Queen of Winter. K'41,130. Syn. of Winter Queen									
Queen Pear. L. Syns. Queen of Pears, Reine des Poires	Fr	obop	ml	yeru	cobe		p		
Queen's Pear Pr11. K'32,130. GenF'37,277. D'45,341,'57,578,'69,818. E'54,397, '59,423. F281. Syn. of Muscat Robert									
Queen Victoria. L. Syn. Reine Victoria	Belg.?	obop	m	gy	dmj	s		l	Supposed to have been raised by Dr. John Van Mons.
Quenast. L. T'97,712. Syn. Beurre de Quenast		roblp	m	gyru	mj	sp		m	Description from Annals of Pomology.
Quentin. L. Syn. Beurre St. Quentin	Fr		m		b				Published by Kenrick, 1841, p. 168.
Quessoi d'Hiver. MagofH'57,259									Not described.
Quessoy d' Ete. T'97,712. Syn. of Caissoy d'Ete									
Quetier. R. Syn. Beurre Quetier									In the experimental orchard at Agassiz, B. C.
Quilletette MagofH'43,388. MassH'44,61. D'45,407,'52,538,'69,840. E'54,398. H183. F282.	Belg	rob	sm	gru	bm	sp	gp	m	Mr. Downing received it from Dr. John Van Mons.
Quilletette (of Manning). A'54,239									Rejected by Congress of Fruit Growers, 1849.
Quimper. L. Bul6. Syns. Supremo de Quimper, Supreme Quimper	Belg	rp	m	yrru	jm	sp	g-vg	e	
Quince. MassH'66,46	Mass		ml		j	s		me	Fruited in 1862. Raised by Dr. S. A. Shurtleff.
Quince. MagofH'39,37. MassH'45,90. Syn. of Bicknell									
Quinn. Hort'67,42,117,'72,118. AHortA'68,80. D'69,840. GarM'72,58. PaFS'72,47. NJH'76,5,'77,22. Syns. Beurre Knight, Knight's Seedling, Quinn Knight.	Eur	ap	ms	yru	j		g	l	Imported to New Jersey by Prof. Mapes.
Quinnebaug. A'69,48		oblp	l				p	me	
Quinn Knight. Hort'67,42. Syn. of Quinn									
Quinnipiac. MagofH'52,492. Hort'52,475	Conn								Raised by Governor Edwards, of New Haven, Conn.
Quinnipiac. D'57,547,'69,850. T'75,554,'85,569,'97,712. Syn. of Ghislain									
Quisse Madame. K'32,130,'41,118		oblp		yrb	j	sp		e	Possibly same as Windsor.
Quittellette. E'59,423	For	r	ms	gru				ml	
Rachinquin. L. Syn. De Rachinquin	Fr.?	r		gru	mb	s		ml	Was produced by M. Noisette.
Radish. DomEncIV,186. Th189								e	Published in the Domestic Encyclopedia, 1804.
Railroad Fuss. Hort'63,58. D'69,831. Syn. of Penn									
Rallay. E'54,382,'59,406. H183. OH'66,58. D'69,840. FGAofO'74,12. T'75,554,'85. 569 '97,712.		rp	sm	yrru	bjg		g	ml	Elliott received it from Ellwanger & Barry.
Rameau. MassH'45,89. A'54,239. F278. Syn. of Veterans									
Rameaux. MagofH'51,472									This may be Veterans.

Ramillies. K'41,165. MagofH'43,128.		oblp	l						Not described.
Rance. L. T'97,712. Syns. Beurre d'Ardempont du printemps, Beurre Bon Chretien, Beurre de Flandre, Beurre d'Hiver, Beurre de Norchain, Beurre de Rance, Beurre de Ranz, Beurre de Rhin, Beurre Epine, Beurre Norchain, Beurre Rance, Beurre Ranse, Beurre Ranz, Beymont, Bon Chretin de Rance, Bon Chretien de Rans, Gastelier, Hardenpont du Printemps, Jenart, Josephine (incorrectly of some), Norchain, Ranz.		obtp	m	gru	mg	s	vg	vl	Very highly esteemed by English cultivators.
Rannaja. IaH'80,61	Rus.								Not described.
Ranwez. L. Syns. Consilleur Ramiez, Conseiller Ramnez, Conseiller Ranwez, Conseiller Ranweze, Consellier Ranwez, Conseilleur Ranwez.	Belg.	obtp	l	gyru	cojgm	svp	g	m	Raised by Dr. John Van Mons.
Ranz. T'97,712. Syn. of Rance									
Rapalye's Seedling. T275. Syn. of Rapelje									
Rapelje. E'54,382,'59,406. D'57,538,'69,840. A'58,195. T'75,554,'85,569,'97,712. Syns. Rapalye's Seedling, Rapelje's Seedling.	N. Y.	oblp	m	yeru	gjm	svp	vp	me	Introduced by Professor Stevens, of Astoria, N. Y.
Rapelje's Seedling. Hort'46,239. MagofH'47,449. E'54,382,'59,406. B'83,383. Syn. of Rapelje.									
Rateau. Pr110. Syn. Gros Rateau.		t	vl	gr	b	s		l	Mr. Lyon thought that this was Catillac.
Rateau Gris. F282. Syn. of Louvain.									
Ravenswood. A'58,196. E'59,406. Hort'61,374,'64,292. D'69,840. KanH'77,213. Syns. Erhard's Ravenswood, Erhard's Seedling.	N. Y.	obop	s	yr	cojm	v	g-vg	me	Originated at Ravenswood, Long Island, N. Y.
Ravu. MagofH'59,256.			m	gy				me	Only partially described.
Raymond. Pr214. K'32,183. M'38,79,'44,66,'47,65. D'45,409,'57,538,'69,840. E'54, 397,'59,424. H183. F274. T'75,278,'85,296,'97,473.	Me.	obop	m	yrru	bmj	sp	g-vg	me	Originated by Dr. J. Wright, at Raymond, Me.
Raymond de Moutlaur. NYC'90.									Published in circular of New York Experiment Station, 1890.
Raymould. OH'95,8.									Published as a new variety. May be Raymond.
Rayner's Seedling. MagofH'42,250. Syn. of Hacon.									
Reading. MagofH'53,173,'54,75,269. AgR'54,272. Hort'56,59,'66,79. D'57,538,'69, 841. H183. F275. E'59,407. PaFS'68,18. T'75,290,'85,308,'97,481.	Pa.	obop	ml	yru	gm	v	g	vl	Originated in Berks County, Pa.
Read's Seedling. Hort'47,533. D'57,530,'69,825. T'75,554,'85,569'97,712. Syn. of Oswego.									
Reading Sugaret. OH'65,41.									Exhibited by Ellwangar & Barry at meeting of Ohio Society, 1865, p. 41.
Real Jargonelle. Pr152. D'45,337,'57,514,'69,758. E'54,373,'59,393. F280. Syn. of Jargonelle (Eng.).									
Red Anjou. L. Syns. Beurre Rouge d'Anjou, Rouge d'Anjou.	Fr.	robop	ms	yru	m	s	g	m	
Red Bergamot. C184. Pr68. K'32,139,'41,120. H183. AgR'54,263. D'69,841. Syns. Crassane d'Ete, Bergamotte Doree, Bergamotte Musque, Bergamotte Rouge, De Sicilie, De Sicilie Musque, Du Colombier, Petit Muscat d'Automne, Red Bergamot.		robop	ms	yr	dmj	s		me	
Red Bergamot. Gb. MHSC'82,57. IaH'82,83,'83,103. FGAofO'83,221. IndH'85,27. EFABC'00. CanExFR'03,421. Syns. Bergamot Krasnui, Bergamotte d'Automne, Rothe Bergamotte.	Rus.								Introduced from Russia in 1879.
Red Beurre. GenF'33,196,'37,277. D'45,357,'57,471,'69,710. F238,277. Syn. of Brown.									
Red Beurre (incorrectly of some). GenF'33,196. D'45,380,'57,437,'69,745. F279. Syn. of Gray Doyenne.									
Red Burgamot. SW. Syn. of Red Bergamot									
Red Butter. Pr49. K'41,130. D'69,710. Syn. of Brown									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Redcap. DomEncIV,189. GarCal587. Syn. Kappesbirne (of the Germans)		r	m	yb				vl	Published in Domestic Encyclopedia, 1804.
Redcheek. Pr148. K'32,140,'41,127. MagofH'43,357. Syns. English Catharine, English Red Cheek.								me	Published by Prince, p. 148.
Red Cheek. D'45,339,'57,514,'69,767. E'54,395,'59,421. F280. Syn. of Largonelle Fr.									
Red Cheeked Seckel. D'45,405,'57,445,'69,857. HovII,33. E'54,395,'59,417. Syn. of Seckel.									
Red Doyenne. Pr148. K'32,141,'41,132. GenF'35,196,'37,277. D'45,380,'57,427,'69,745. [illegible] F[illegible]. [illegible],'97,712. Syn. of Gray Doyenne.									
Redfield. A'67,[illegible],'69,[illegible],'77,[illegible]	Utah.								Originated in Salt Lake City, Utah.
Red Flowering. WPr12. Pr27. Syn. of Sanguinole.									
Red Garden. D'69,841	Pa.	obop	m	yru	com	[illegible]	g-vg	me	Raised by J. Youngken, Richlandtown, Pa.
Red Janet. MagofH'43,131. Syn. of Janet.									
[illegible]									
Red Muscadel. D'45,339,'57,514,'69,767. E'54,395,'59,421. H194. F282. Syn. of Largonelle Fr.									
Red Muscadelle. GarCal587. Pr26. Syn. of Beauty (Sum.)									
Red Muscat. Pr12. Syn. Muscat Rouge		p	s	ygr	co	p		me	
Red Orange. Pr19. K'32,152,'41,119. D'69,824. Syn. of Orange.									
Red Panna. FGAofO'92,109. Syn. of Princess.									
Reeder. FGAofO'88,57. HHF'89,175,187,'90,[illegible]. F'97,712. Bul[illegible]. AHM[illegible]. Syns. Dr. Reeder, Doctor Reeder, Reeder's Seedling.	N. Y.	rovp	sm	yru	dmg	vp	vg-b	nl	From seed of Winter Nelis. Originated in Seneca County, N. Y.
Reeder's Seedling. A'67,150. AtofHIV,40. D'69,759. Syn. of Reeder.									
[illegible] Syn. of Bon Chretien (Sum.)									
Reed's Seedling. Hort'47,324. E'51,380,'59,402. Syn. of Oswego.									
Refreshing. IndHS'92. NYC'90. HHF'92,175. MichB31. BBL. EFABC'00.	Vt.?								In the trial orchards of Benj. Buckman, Farmingdale, Ill.
Regine. F'75. D'69,841.	Belg.	rp	m	gyru	jm	[illegible]	g	me	Raised by Dr. John Van Mons.
Regentin. Pr213. D'45,444,'57,532,'69,829. E'54,380,'59,403. F281. Syn. of Passe Colmar.									
Regnier. A'54,185. Syn. Regner	Pa.								Originated with Madame Regnier, Philadelphia, Pa.
Regnier. F'59,356. AgR'62,183. Syn. of White Doyenne.									
Reid's Seedling. MagofH'47,198,450. Syn. of Oswego.									
Regner. MagofH'53,518,'54,26. Syn. of Regnier.									
Reguer. D'57,[illegible],'69,880. F.79. E'59,[illegible]. Syn. of White Doyenne.									
Reine. L. Syn. Beurre de Reine.	For.								Published by Field, p. 278.
Reine Caroline. MagofH'38,436,'40,44. D'45,408,'57,580,'69,841. E'54,398,'59,423. H185. T'75,554,'85,560,'97,712. Syn. of Caroline.									
Reine d'Hiver. B'51,318. A'54,239. AgR'54,243. F282. D'69,841. Syn. of Winter Queen.									

Reine des Belges. F282. Syn. of Belges									
Reine des Pays Bas. K'41,154. D'45,406,'57,580,'69,839. MassH'45,89. E'54,382,'59,406. F282. Syn. of Low Countries.									
Reine des Poires. M'38,84,'44,69'47,93. K'41,154. D'45,408,'69,842. MagofH'48,112. A'54,239. E'54,398,'59,423. H184. F282. Syn. of Queen Pear.									
Reine des Verges. GHM&S'90,'94. IHH'96,209,'00,253									May be Helene of Mr. Lyon.
Reine de Vierge. D'69,749. Syn. of Helene									
Reinette. R. Syn. Bergamotte Reinette		r	m					me	Published in Magazine of Horticulture, 1860, p. 219.
Reine Victoria. D'69,842. Syn. of Queen Victoria									
Reinwardt. R. Syn. Bezi Reinwardt									Published in Magazine of Horticulture, 1855, p. 146.
Reliance. GaH'90,24,'92,40. PJB'93. LaB22. MichSB30. IHH'96,204,209. T'97,456.	Ga		s				vg	c	Named by Georgia Horticultural Society on account of its fruitfulness.
Remmington. MagofH'47,557									Not described.
Remsen. R. Syn. Remsen's Favorite									Not described.
Remsen's Favorite. MagofH'37,49,'39 292,'43,388. MassH'43,29. Syn. of Remsen									
Remy Chantenay. EFABC'00. Syn. of Chantenay									
Rene Dunan. CanExFR'00,462. EFABC'00. Syn. of Dunan									
Reserve Pear. Pr152. D'69,758. Syn. of Jargonelle (Eng.)									
Retour. R. Syn. Retour Van Mons									Not described.
Retour de Rome. F281,282. A'60,157. Dap155. Syn. of Poiteau									
Retour de Rome. MassH'53,21,'56,19. MagofH'54,86. AgR'56,330. D'57,539,'69,842. E'59,407. T'75,554,'85,569,'97,712. Syn. of Rome.									
Retour Van Mons. MagofH'53,40. Syn. of Retour									
Reveillere. R. Syn. Reveillere le Paux									Not described.
Reveillere le Paux. MagofH'37,51. Syn. of Reveillere									
Revel. EFABC'00									Not described.
Reves. R. Syn. Madame Adelaide Reves									Published in Magazine of Horticulture, 1857, p. 302.
Revillere. F282	For								Not described.
Rey. L. Syns. Beurre Leon Rey, Leon Rey	Fr	rp	m		mj			me	Obtained by Leon Rey at Toulouse, France.
Reynaer. L. Syn. Reynaer Beernaert	Belg	rp	m	yr	mj	s		l	Raised by Dr. John Van Mons.
Reynaer Beernaert. MagofH'60,220. D'69,842. Syn. of Reynaer									
Rezenas. F212,279. Syn. of Angouleme									
Rheims. L. Syns. Autumn Catherine, Green Catharine, Late Catherine, Musk Spice, Petit Rousselet, Rousselet, Rousselet de Rheims, Rousselet Musque, Rousselet of Rheims, Rousselet Petit, Rousselet Spice (of some), Rousselette de Rheims, Spice, Spice or Musk Pear.	Fr	obop	s	ygbr	bm	sp	g	me	Originally from Rheims; supposed parent of Seckel.
Rhine. L. Syns. Beurre de Rhine, Beurre Rhine		p	l	y	co		g	m	Exhibited at meeting of Cincinnati Horticultural Society, 1855.
Richards. MagofH'56,540. Cult'56,339. A'56,90,145. AgR'56,368. D'57,540,'69,842. F277. E'59,407. T'75,554,'85,569,'97,713. Syn. Richards' Beurre.	Del	obop	m	yru	bmg	sv	g	m	Originated at Wilmington, Del.
Richards' Beurre. Hort'57,573. Syn. of Richards									
Richards' Beurre (of some). Hort'57,573. E'54,399,'59,424. D'69,863. Syn. of Bon Chretien (Sum.).									
Richardson. L. Syn. Richardson's Seedling		obo	ml	y	m				
Richardson. IHH'67,191,212,'68,76. GarM'72,315. Syn. August Pear	Ill								Raised by Jona Huggins, Macoupin County, Ill.
Richardson's Seedling. T'75,554,'85,570,'97,713. Syn. of Richardson									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Riche. L. Syn. Leopold Riche	Belg	obtp	l	yeru	coj	s		ml	Raised by M. de Jonghe. Described by Hogg.
Riche d'Apoie. Pr205. K'32,183. Syn. of Riche Depouille									
Riche d'Italie. Pr114. Syn. of Italie									
Riche Depouille. Pr205. K'32,183. Syn. Riche d'Apoie									Not described
Richelieu. L. T'97,213. Syn. Buerre Richelieu		obtp	l	gy	bjm	sp	g-vg	l	
Riche Ronde. MagofH'43,131									Not described.
Richmond. Pr147. D'69,779. Syn. of Harrison									
Richmond. D'69,850. Syn. of Saint Germain									
Rickerby. R. Syn. Rickerby Imperial									Not described.
Rickerby Imperial. MagofH'43,131. Syn. of Rickerby									
Ridal. E'59,421. Syn. of Jargonelle (Fr.)									
Ridelle. MassH'45,87. Syns. Audusson, Beurre Audusson, Poire Ridelle, Poire Ritelle, Ridelle's.		ovtp	m	yr	j		g p	me	
Ridelle's. D'57,540,'69,842. F282. E'59,407. T'75,554,'85,570,'97,713. Syn. of Ridelle.									
Riga. R. Syn. Riga 108									In the experimental orchard at Agassiz, B. C.
Riga 108. EFABC'00. Syn. of Riga									
Rigoleau. R. Syn. Poire Rigoleau		r	s	yru		p		m	Published in Magazine of Horticulture, 1854, p. 136.
Riha. R. Syn. Riha's Seedling									In the experimental orchard at Agassiz, B. C.
Riha's Seedling. EFABC'00. Syn. of Riha									
Rio de Louvain. Cult'47,340									Not described.
Rio de Rome. Cult'47,340									Not described.
Rio de Wurtemberg. HovI,5. E'54,325. F280. Syn. of Glout Morceau									
Rio de Wurtemberg. MagofH'38,391,436. E242. D'69,767. Syn. of Wurtemburg									
Ripson. HAJ'86,24									Probably a misprint for Ritson.
Rip Van Winkle. Cult'43,121,153. MagofH'44,396. MassH'44,64	N. Y. ?								Exhibited by William R. Prince at meeting of Massachusetts Horticultural Society, 1844.
Ris de Loup. D'69,772. Syn. of Gilogil									
Ritson. GarM'85,368. CanH'85,268,'91,387,'95,74,'99,165,'05,175. FGAofO'91,10. C(O)HS'91,147. BBL. FESofO'02,73,'04,47.	Can	p	m	gyru	jb		vg	m	Origin with John Ritson, of Oshawa, Ontario.
Ritter. MagofH'57,106. Hort'57,110. CGenIX,190									Tree planted at Reading, Pa., in 1857, for Seckel.
Rivers. L. Syns. Rivers' Winter Beurre, Winter Beurre (Rivers)	Eng	rp	m	gru	gmb	vsa	g	vl	Raised by Thomas Rivers, of England.
Rivers Beacon. AofH'92,277									Not described.
Rivers Princess. EFABC'00									In experimental orchard at Agassiz, B. C.
Rivers Summer. R. Syn. Rivers' Summer Beurre d'Aremberg	Eur							e	Probably of little or no value.
Rivers' Summer Beurre d'Aremberg. AJofH111,295. Syn. of Rivers Summer									

Rivers' Winter Beurre. A'58,185. AgR'58,394. D'69,843. Syn. of Rivers									
Robert. R. Syn. Beurre Robert	Fr.	oblp	l	gybru	mdj	sp	....	ml	Originated near Angers in 1860 or 1861.
Robert's Keeping. Pr77. D'45,420,'57,564,'69,751. E'54,389,'59,417. F277. Syn of Easter Bergamot.									
Robert's Muskateller. D'69,818. Syn. of Muscat Robert									
Robertson. MagofH'44,296. D'45,422,'69,878. E'54,345,'59,356. AgR'64,143. Syn. of Washington.									
Robin. K'41,119. T'97,477. Syns. BeurreRobin, Doyenne Robin, Doyenne Robin (of Langlier), Royale d'Ete, Royal Summer.	Fr.	rob	m	gyru	cojmg	vp	g	me	Raised by M. Robin, Angers, France.
Robine. Pr33. K'32,131. Syns. Averat Pear Royal Muscat pear of August, Avorat, Avorat Robine Muscat d'Aoust August Muscat, Poire d'Averat Averat Pear Poire Royale Royal Pear, Robine Averat Poire Royale Muscat d'Aout, Royale d'Ete, Royal Summer.		t		gy	cod				May be same as Robin.
Robine. Pr11. K'41,118. D'69,818. Syn. of Muscat Robert									
Robine. F282. Syn. of Royal Summer									
Robine Averat Poire Royale Muscat d'Aout. Pr33. Syn. of Robine									
Robinson. MagofH'44,297. D'57,559,'69,878. Syn. of Washington									
Rochefort. L. Syn. Rousselet de Rochefort	For.								Published by Field, on p. 282; not described.
Rodney. A'56,89,157. AgR'56,367	Del.								Grown for stocks for double working.
Roe. L. Syn. Roe's Bergamot	N. Y.	ob	m	yr	com	sp	g-vg	me	Raised by William Roe, of Newburgh, N. Y.
Roe's Bergamot. D'57,540,'69,843. F275. E'59,407. T'75,284,'85,302,'97,477. Syn. of Roe.									
Rogers. A'67,157. Dap133. Syns. Dean, Dean's Seedling	Mass.	ovp	m	ygr	cojm	vp	g-vg	me	Introduced by A. J. Dean, of Boston, Mass.
Rogers. BBL. Syn. of Kincaid									
Rogers' Elizabeth. Hort'75,244. Syn. of Archangel									
Rogers Seedling. MassH'75,119									Not described.
Rogers Winter. IndH'94,145									Exhibited at meeting of Indiana Horticultural Society, 1894, by Addison Hadley.
Rohan. L. Syns. Camille de Rohan, Prince Camille de Rohan	Eur.	robo	m	yru	gm	v	g	l	
Roi d'Ete. Pr21. K'32,128. F282. D'69,843. Syn. of Summer King									
Roi d'Ete (erroneously). Pr24. Syn. of Archduke									
Roi de Louvain. D'69,716. Syn. of Catillac									
Roi de Rome. K'32,198. D'64,843. Syn. of Rome King									
Roi de Rome (erroneously). GenF'33,197. D'45,401,'57,526,'69,819. E'54,378,'59,400. F249,281. Syn. of Napoleon.									
Roi de Wurtemburg. GenF'33,197. D'45,437,'57,503. HovI,5. E'54,325,'59,339. [illegible] AgR'62,185. Syn. of Glout Morceau.									
Roi de Wurtemburg. K'32,173. MagofH'38,391,436. F242. D'69,767. Syn. of Wurtemburg.									
Roi Jollimont. D'69,742. Syn. of Summer Doyenne									
Roi Louis. Pr15. K'32,128. F274. D'69,775. Syn. of Blanquette									
Roi Louis Nouveau. D'69,688. Syn. of Duval									
Roitelet. Hort'68,76. D'69,843. MassH'77,79. A'81,99	Fl.	r	s	yru	mj	s	g	me	
Roleby. D'69,844	Belg.	obop	ms	yrru	m	va	p	me	Raised by M. Bivort.
Rolley. WNYH'89,159									Exhibited by Ellwanger & Barry; not described.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Rolmaston. R. Syn. Rolmaston Duchess		p	m	yg	jm	v	g	m	Published by the Horticulturist, 1874.
Rolmaston Dutchess. Hort'74,148. FGA of O'74,14. Syn. of Rolmaston									
Romain. L. T'97,713. Syns. Beurre de Rome, Beurre Romain, Fondante de Rome, Gros Romain, La Reine, Roman Beurre.		obop	m	yg	j	s	g-vg	m	Variable in quality; sometimes very good.
Roman Beurre. Pr55. Syn. of Romain									
Rome. L. Syn. Retour de Rome	Belg.	robop	m	yru	cogmj	va	g	me	Originated by Dr. John Van Mons.
Rome King. L. Syn. Roi de Rome	Belg.	oblp	vl	yeru	dmj	s		m	First fruited in 1810.
Rondelet. MagofH'46,340,'52,436. MassH'51,189. WHRIV,205. E'54,382,'59,407. AgR'54,263. H184. F282. D844.		rob	ms	gybru	dbmj	sp		m	Described by Hogg in the Fruit Manual.
Ronville. Pr63. K'32,147,'41,124. MagofH'40,391,'49,442. D'69,844. Syns. Hoerenaille, Lord Martin Pear, Martin Sire (incorrectly), Poire de Bunville.	Belg.	ova	ml	ygru	beg	s		m	Probably of little or no value.
Roosevelt. RNY'05,823,826	Fr.	rp	vl	yb	m	s	g	m	Introduced by M. Charles Baltet, of Troyers.
Ropes. MagofH'46,500. E'54,382,'59,407. D'57,541,'69,844. H184. F275. T'75,554,'85,570,'97,713.	Mass.	ovobo	m	erru	comj	sp	g	m	Originated in the garden of Mr. Ropes, of Salem.
Rosabirne. Hort'53,65. E'54,383,'59,408. D'57,541. H185. F282. T'75,554,'85,570,'97,713.		p	m	gru	j	va		m	
Rose Doyenne. T'97,713		obo	ml	yer	cog	p		m	Not desirable; rots at the core.
Rose Epine Rose. Pr38. D'69,863. Syn. of Rose (Sum.)									
Rosenbirne (of the Germans). Pr38. K'42,132. D'45,345,'57,583,'69,863. Syn. of Rose (Sum.).									
Rose Perfume. L. Syn. Parfume de Rose	Belg.	oblp	s	yru	jm	s	p	m	Considered of little value by Mr. Downing.
Rose (Sum.). L. Syns. Beurre Hatif, Bigarride, Bute Bonne d'Automne, Caillaurozat, Cailleau Rosat, Caillou Rosat, Caillorozar, Caillot Rosat, Caillot Rosat d'Ete, Calua Rosat, De Cailleau, De Caillot, D'Eau Rose, De la Montiers, De Monsieur, English Caillot Rosat, Epine d'Ete, Epine d'Ete Couleur Rose, Epine Rose, New Long Rosewater, Ogon, Ogon de Xaintonge, Peral del Campo, Poire d'Eau Rose, Poire de Malthe, Poire d'Ogon, Poire de Rose, Poire Tulipee, Rose Epine Rose, Rosenbirne (of the Germans), Rozatte d'Ingrandes, Rozatte du Dauphine, Summer Rose, The Rose Pear, Thorny Rose, Tulipee, Viliane d'Anjou.		r	m	yrru	co		p	e	Very old and not valuable.
Rosewater. L. Syn. Long Rosewater				gy	j	v	g	ml	
Roslyn. D'69,844	N. Y.	r	m	yru	jm	v	g-vg	e	Found on the place of William C. Bryant, Roslyn, N. Y.
Rosman. L. Syn. Besi Rosman	For.								Published by Field, p. 278.
Rosmette. MagofH'52,39									Not described.
Ross. K'41,165. MagofH'43,128,'47,152. E'54,382,'59,408. H184	Eur.	obo	m	ygru	com		g	l	
Rosseels. R. Syn. Madame Rosseels									In the experimental orchard at Agassiz, B. C.
Rossney. HB&T. AJC'02. IIIH'99,219,'03,207,273,'04,223,'05,291. YB'04,402. AS'04,5,64. OH'04,29. WNYH'04,24. AHM260. MdH'05,86.	Utah		l	yr	bm	s	vg	m	From seed of Bartlett or Winter Nelis planted in 1881.

Rostieza. Cult'54,286. CGenXVII.50. IllH'69,158. HMHS241. Syn. of Rostiezer									
Rostiezer. M'38,72,'44,66,'47,69. D'45,410,'57,442,'69,845. B'51,301,'83,365. Wg73. Hov1,49. AgR'50,94. Cole154. E'54,335,'59,346. Cult'54,286. Hort'54,355,'55,64,'71,61. H185. F255. T'75,252,'85,270,'97,453. Syn. Rostieza.	Eur.	oblp	ms	ygrb	jmb	sp	vg-b	me	Exhibited at meeting of Massachusetts Horticultural Society, September, 1837.
Rothe Bergamotte. MHSC'82,57. FGAofO'83,221. Syn. of Red Bergamot									
Rouan. R. Syn. Beurre de Rouan									In the experimental orchard at Agassiz, B. C.
Rouen. L. Syn. Milan de Rouen	Fl.	r	m	gyru	cojm	v	p	me	Not of great value.
Rouennaise. L. Syn. Belle Rouennaise	Fr.	rp	m	yru	dmj	sp		m	Introduced in 1856.
Rouge. T'97,713. Syn. of Brown									
Rougeaude. Prss		p		yr	d	s		l	
Rouge d'Anjou. D'69,697. FGAofO'73,82. Syn. of Red Anjou									
Rouges des Vierges. F282. D'69,717. Syn. of Summer Certeau									
Roulef. CanH'94,292	Rus. ?		m	y		v			Probably introduced from Russia.
Round Bergamot. CanH'85,39. Syn. of Sapieganka									
Round Blanquet. L. Syns. Gros Blanquet Rond, Grosse Blanquette Ronde, Large Round Blanquet.		r	s	yr	co	s	p	ve	Not valuable.
Round Top. Hort'56,35. D'57,554,'69,872. E'59.412. Syn. of Uwehlan.									
Rouselench. Cult'39,66. K'41,165. MagofH'50,296. Syn. Rouse Linch	Eng.	obl	l	g	b			vl	Raised by Thomas Andrew Knight; introduced in 1840.
Rouse Linch. MagofH'39,395. Syn. of Rouselench									
Rouse Lench. GenF'33,197. D'69,845. Syn. of Lench.									
Rousselet. R. Syn. Rousselet de Cour	For.								Not described.
Rousselet. C184. D'45,343,'57,581,'69,846. E'54,399,'59,424. F282. Syn. of Rheims									
Rousselet. Pr21. E'54,399,'59,424. Syn. of Summer King									
Rousselet Aelens. MagofH'60,220. D'69,845. Syn. of Aelens									
Rousselet Bivort. D'69,845.	Belg.	obop	m	yru	djbm	s	g vg	ml	From seed of Simon Bouvier in 1840.
Rousselet d'Anjou. Pr125. K'32,143. Syn. of Caissoy									
Rousselet Decoster. D'69,845. Syn. of Decoster									
Rousselet de Cour. F282. Syn. of Rousselet									
Rousselet d'Esperin. E'59,408. Syn. of Esperen									
Rousselet de Grand Bretagne. Pr22. Syn. of British Russet									
Rousselet D'Hyver. K'41,128. A'54,239. Syn. of Winter Rousselet									
Rousselet d'hiver. Pr21,58. Syn. of Sec									
Rousselet de Jamin. D'69,750. Syn. of Dundas									
Rousselet de Janvier. D'69,845. Syn. of Janvier									
Rousselet de Jonghe. D'69,846. Syn. of Jonghe Rousselet									
Rousselet de Meester. MagofH'42,58,'43,131,'48,206. D'45,409,'57,581,'69,844. B'51,316. E'54,398,'59,424. AgR'56,331. H185. F282. T'75,554,'85,570,'97,713. Syn. of Marie Parent.									
Rousselet de Rheims. C186. Pr20. K'32,131,'41,119. GenF'33,197,'37,277. M'38,69,'44,75,'47,75. Cult'39,66. D'45,343,'57,581,'69,846. Cole160. E'54,399,'59,424. H184. F282. T'75,554,'85,570,'97,713. L18. Syn. of Rheims.									
Rousselet de Rochefort. F282. Syn. of Rochefort									
Rousselet de Stutgart. AgR'58,422. IllH'63,22. FGAofO'72,14. Syn. of Stuttgart.									
Rousselet Double. Hort'53,64. D'57,540,'69,846. F282. Syn. of Esperen									
Rousselet Double Esperen. Hort'53,64. E'54,383. H185. Syn. of Esperen									
Rousselet Enfant Prodigue. D'57,540,'69,846. F282. Syn. of Enfant Prodigue									
Rousselet Esperen. D'57,540,'69,846. F282. T'75,554,'85,570,'97,713. Syn. of Esperen.									
Rousselet Hatif. C178. Pr20. K'32,127,'41,119. M'38,65,'44,50,'47,57. D'45,343,'57,581,'69,846. E'54,394,'59,421. AgR'56,344. H184. F282. A'62,68. T'75,554,'85,570,'97,713. L18. Syn. of Early Rousselet.									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Rousselet Hatif. Pr138. MagofH'43,131. Syn. of Skinless									
Rousselet Jamain. F280. Syn. of Dundas									
Rousselet Jamin. MagofH'55,185. D'57,489,'69,750. F279. Syn. of Dundas									
Rousselet le Gros. F282. Syn. of Summer King									
Rousselet Musque. D'69,846. Syn. of Rheims									
Rousselet of Rheims. Pr20. E'54,399. Syn. of Rheims									
Rousselet Perdreau. F282. Syn. of Early Rousselet									
Rousselet Petit. GenF'33,197. Syn. of Rheims									
Rousselet Precoce. MagofH'52,151		oblp	l	y		a	p	m	
Rousselet St. Nicholas. MagofH'55,189. D'69,847. Syn. of Nicholas									
Rousselet Spice (of some). GenF'33,197. Syn. of Rheims									
Rousselet Stuttgart. B'51,301. Hort'55,65. D'57,541.'69,847. F282. A'62,70. MoH'69, 498. T'75,554,'85,570,'97,713. HHH'78,129. Syn. of Stuttgart.									
Rousselette d'Anjou. Pr125. F278. D'69,700. Syn. of Caissoy									
Rousselette d'Esperew. K'41,170. MagofH'42,250. Syn. of Esperew									
Rousselette d'Hiver. Pr21. E'54,377,'59,398. D'57,557,'69,814. F281. Syn. of Sec									
Rousselette de Rheims. C186. Pr20. M'38,69. Cole160. A'54,239. H184. F282. D '69,846. T'85,570. Syn. of Rheims.									
Rousselette Hatif. M'38,65. Syn. of Early Rouselet									
Rousselett St. Vincent. MagofH'50,296. A'54,239									Rejected by Congress of Fruit Growers 1849.
Rousselet Vanderweeken. MagofH'57,155. D'57,541,'69,847. F282. E'59,408. T'75, 554,'85,570,'97,713. Syn. of Vanderweeken.									
Rousselet Var. L. Syn. Rousselet Variegated	For								Not described.
Rousselet Variegated. F282. Syn. of Rousselet Var									
Rousseline. Th189. Pr90. K'32,140,'41,122. Cult'39,66. MagofH'43,131. F282. D'69,847. Syns. Brutte Bonne (erroneously), Long Tailed Muscat, Long Stalked Muscat of the End of Autumn, Muscat a longue Queue, Muscat a longue Queue de la fin d'Automne, Poire Rousseline, Poire Rousselon, Russelin.		r	s	yr	m	sp	g		Not of value.
Rousseline (of some). GenF'33,198. K'41,138. Syn. of Thumb									
Rousselon. D'57,536,'69,847. F282	Belg	obo	m	yru	djm	svp		vl	Raised by Maj. Esperen in 1846.
Rousset or Roussette d'Anjou. Pr106 Syn. of Merveille									
Roussette d'Anjou. Pr125. K'41,122. F278. D'69,700. Syn. of Caissoy									
Roussette de Bretagne. Pr22. Syn. of British Russet									
Roxbury St. Germain. MagofH'44,293. Syn. of Lewis									
Royal. D'69,847. Syn. Peck's Seedling	N. Y	rp	m	yeru	jm	sp	g-vg	me	Raised by Thomas R. Peck, of Waterloo, N. Y.
Royal d'Angleterre. D'57,537,'69,835. F283. AJofHV1,50. Syn. of Pound									
Royal d'Hiver. MagofH'50,296									Rejected by Congress of Fruit Growers, 1849.
Royal d'Hiver. F282. Syn. of Royal Winter									
Royale. F277. T'97,713. Syn. of Diel									
Royale. D'69,863. Syn. of Franc Real (Sum.)									

Royale. F282. E'59,409. Syn. of Saint Dorothee									
Royale d'Ete. Pr33. K'32,131,'41,119. Syn. of Robine									
Royale d'Ete. F282. Syn. of Royal Summer									
Royale d'Hiver. C202. Pr81. K'32,148,'41,124. MagofH'43,131. A'54,239. H184. D'69,848. Syn. of Royal Winter.									
Royale Nouvelle. D'57,547,'69,849. Syn. of Saint Dorothee									
Royale Muscat. Pr11. Syn. of Muscat Royale									
Royal Summer. L. Syns. Robine, Royale d'Ete	For								Published by Field, p. 282; not described.
Royal Summer. Pr33. K'41,119. Syn. of Robine									
Royal Tarling. D'45,429,'57,564,'69,751. E'54,389,'59,417. F277. Syn. of Easter Bergamot.									
Royal Thorn. L. Syn. Epine Royale	Fr	p	m	yr	dmj	sv		m	Reported by the Society of Van Mons.
Royal Vendee. EFABC'00									In the experimental orchard at Agassiz, B. C.
Royal Winter. SW. Pr81. K'32,148,'41,124. D'69,848. Syns. Royal d'Hiver, Royale d'Hiver, Royal Winter, Spina di Carpi, Winter Royal.		obop	ml	yr	bmj	s		l	Described by Lindley.
Royer. L. Syns. Auguste Boyer, Auguste Royer		r	m	gyru	mj	sp	g	m	
Rozatte d'Ingrandes. D'69,863. Syn. of Rose (Sum.)									
Rozatte du Dauphine. D'69,863. Syn. of Rose (Sum.)									
Ruddy English Bergamot. Pr71. Syn. of Bergamot (Aut.)									
Rude Epee. Pr34. Syn. of Grise-Bonne									
Rudolph. R. Syn. Prince Rudolph of Austria									In the experimental orchard at Agassiz, B. C.
Ruedy. BBL									In the collection of Benjamin Buckman, Farmingdale, Ill.
Rumelburne. F278. Syn. of Heri									
Rushmore. F282. Syn. of Thury									
Rushmore's Bon Chretien. WPr11. Pr147. E'54,396,'59,422. D'57,575,'69,779. L15. Syn. of Harrison.									
Rushmore's Bon Chretien. K'41,127. A'54,239. F280. Syn. of Thury									
Russelet. Pr21. D'69,843. Syn. of Summer King									
Russelin. Pr90. D'69,847. Syn. of Rousseline									
Russet. WHRII,77. OreH'95,79									Reported as grown in Jackson County, Oreg.
Russia. L. Syn. Alexander de Russia	Rus.?	t	l	yru	t	sj	g	me	Published by Prince, p. 197.
Rutter. A'67,151,'99,15. AHortA'70,74. AJofHIV,50. D'69,848. Hort'71,185,'72, 59'74,158. T'75,554,'85,570,'97,713. B'83,383. Bl228.	Pa	rp	ml	gyru	jgm	sv	vg	m	Raised by John Rutter, Westchester, Pa.
Rylsk. CanH'94,292			m		b	s		vl	Published by Canadian Horticulturist.
Rynearson. R. Syn. Rynearson's Pear									In Silas Wharton's catalogue for 1824.
Rynearson's Pear. SW. Syn. of Rynearson									
Sabine. R. Syn. Colmar Sabine			m		b	s		vl	Published by Magazine of Horticulture, 1837, p. 48; 1843, p. 130.
Sabine. D'45,438,'57,513,'69,790. Cult'47,340. E'54,372,'59,392. F281. T'75,554,'85, 570,'97,713. Syn. of Jaminette									
Sabine d'Ete. Pr194. K'32,157,'41,133. GenF'37,277. D'45,339,'57,514,'69,767. E'54,395,'59,421. F276. Syn. of Jargonelle (Fr.)									
Sabine d'Hiver. F282. Syn. of Jaminette									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Sabine (Flemish). A'54,239									Rejected by Congress of Fruit Growers, 1849.
Sabine of the French. MagofH'37,49. K'41,162. Syn. of Jaminette									
Sabine Van Mons. D'69,790. Syn. of Jaminette									
Sacandaga. D'69,849. Syns. Sacandaga Seckel, Van Vranken	N. Y.	r	s	gyeru	jm	sp	g-vg	me	Found on farm of Mr. Van Vranken, Saratoga County, N. Y.
Sacandaga Seckel. D'69,849. Syn. of Sacandaga									
Sacharine. Gb. FGAofO'89,3. IaB3. MeP'99,63. EFABC'00. Syn. Sacharnaya.	Rus.?								Introduced from Russia in 1879.
Sacharnaya. Gb. Syn. of Sacharine									
Saco. D'69,773. Syn. of Goodale									
Sadley. R. Syn. Sadley Jack									Not described.
Sadley Jack. MagofH'43,131. Syn. of Sadley									
Safran d'Automne. D'69,858. Syn. of Spanish									
Safran d'Ete. D'69,863. Syn. of Bon Chretian (Sum.)									
Safran Rosat d'Automne. D'69,858. Syn. of Spanish									
Sagaret. E'54,383,'59,409. Syn. of Signoret									
Sageret. K'41,165. B'51,318. D'69,671. Syns. Bergamotte Sageret, Edouard Sageret.	Fr.	r	m	gbru	jm	s	g	m	
Saharnaya. FGAofO'83,223. Syn. of Sugar									
Saint Andre. MagofH'46,297, Hov1,79. AgR'54,251. F282. D'69,819. Syns Poire St. Andre, St Andre.	Fl.?	obo	m	gyr	gbm		g	me	Imported by Robert Manning in 1834.
St. Andre. MagofH'42,58. D'45,411,'57,548. B'51,318. E'54,338,'59,350. H190. IllH'63,22. T'75,279,'85,297,'97,474. Syn. of Saint Andre.									
St. Augustin. Pr114. Syn. of Augustin									
Saint Augustin. Pr114. K'32,148. MagofH'43,131. F282. Syn. of Augustin									
St. Austin. Pr114. Syn. of Augustin									
Saint Bruno. MassH'48,99. MagofH'50,296. A'54,239									Shown by Robert Manning in 1848.
St. Cerran. D'69,664. Syn. of Mello									
Saint Crispin. Cult'63,181. AJofH111,338. AHortA'69,81. A'69,100. D'69,849. Hort'70,355. MassH'73,97. CGenXXIII, 190. Syn. of Crispin.									
Saint Denis. D'57,581,'69,849. F282. T'75,555,'85,571,'97,714. Syn. of Denis.									
Saint Dorothee. MagofH'48,6,110,'49,199. NAPC'49,38. B'51,318. D'57,547,'69,849. F282. CGenXXV,94. T'75,555,'85,571,'97,714. Syns. Nouvelle, Royale, Royale Nouvelle, St. Dorothee Royale Nouvelle.	Eur.	oblp	ml	gyru	djm	svp	g-vg	m	
St. Dorothee Royale Nouvelle. MagofH'54,236. Syn. of Saint Dorothee									
Sainte-Madelaine. D'69 809. Syn. of Madeleine									
St. Edmund. EFABC'00									In the experimental orchard at Agassiz, B. C.
St. Francis. K'32,153									Not described.
St. Francis Seigner. GarM'71,214. A'71,55									Claimed as distinct; not described.
Saint Francois. Pr. 85. MagofH'43,131,'52,419. Syn. of Bergia									
St. Galen. K'32,183. E'54 336,'59,409. Syn. of Ghislain									
Saint Gall. MagofH'43,128									Not described.

Saint Georges. F282. Syn. of Georges									
Saint Germain. DomEncIV, 181. GarCal587. Th191. Pr95. K'32,148,'41,123. GenF'33,197, 37278. Cult'39,66. H190. F282. D'69,850. Syns. Arteloire, Franklin, Hermansbirne, In connue la Fare, Lafare, Richmond, St. Germain, Saint Germain blanc, Saint Germain brun, Saint Germain d'Hiver, St. Germain Dore, St. Germain Gris, St. Germain Jaune, St. Germain Prince's, Saint Germain Vert, Unknown La Fare, Winter St. Germain.	Fr	obop	l	ygb	gjm	s		l	
St. Germain. C197. SW. Pr95. Cole170. D'45,446,'57,548. B'51,310. H190. T'85, 308. IllH'90,173. Syn. of Saint Germain.									
Saint Germain blanc. Pr95. D'69,850. Syn. of Saint Germain									
St. Germain Blanc. D'45,441,'57,577,'69,804. E'54,397,'59,422. F281. Syn. of Louise Bonne.									
Saint Germain Brandes. Pr211. F278,282. Syn. of Brandes									
Saint Germain Brans. MagofH'43,131									Not described.
Saint Germain brun. D'69,850. Syn. of Saint Germain									
Saint Germain d'Ete. Pr30. D'45,347,'57,582,'69,864. E'54,399,'59,424. F282. Syn. of St Germain (Sum.)									
St. Germain de Graines. D'69,668. Syn. of Julie									
Saint Germain de Martin. D'45,347,'57,582,'69,864. E'54,399,'59,424. F282. Syn. of St. Germain (Sum.).									
Saint Germain de Pepins. D'69,850. Syn. of Pepins									
Saint Germain d'Hiver. D'69,850. EFABC'00. Syn. of Saint Germain									
St. Germain Dore. D'69,850. Syn. of Saint Germain									
St. Germain du Tillay. D'69,668. Syn. of Julie									
St. Germain Dutilleul. D'69,668. Syn. of Julie									
St. Germain du Tilloy. D'69,668. Syn. of Julie									
St. Germain Fondante. F277. D'69,672. Syn. of Antoine									
Saint Germain Gris. F282	For								Not described.
St. Germain Gris. GenF'33,197. D'57,548,'69,850. F282. Syn. of Saint Germain.									
St. Germain Jaune. GenF'33,197. D'57,548,'69,850. F282. Syn. of Saint Germain									
St. Germain Nouveau. D'69,874. Syn. of New St. Germain									
St. Germain Panachee. D'69,850. Syn. of Striped Germain									
St. Germain Prince's. L18. Syn. of Saint Germain.									
Saint Germain Puvis. AHortA'68,81. AJofHII,45. D'69,839. Syn. of Puvis									
Saint Germain Striped. MagofH'43,131. Syn. of Striped Germain									
St. Germain (Sum.). L. Syns. Hoe-Langer Hoe-Liever, Jargonelle des Provencaux, Jargonelle of Provence, Joli-Mont (of some), Saint Germain d'Ete, Saint Germain de Martin, Short's Saint Germain, Summer St. Germain.		obop	m	g	jd	a	p	me	Probably of no value.
St. Germain Tillon. MassH'48,99									Shown at meeting of Massachusetts Horticultural Society by Robert Manning.
Saint Germain Van Mons. F282. Dap133. Syn. of Germain (Van Mons)									
Saint Germain Variegated. F282	For								Not described.
Saint Germain Vauquelin. F283. MagofH'60,221. D'69,874. AofH'91,296. Syn. of Vauquelin.									
Saint Germain Vert. D'69,850. Syn. of Saint Germain									
St. Ghislain. M'38,71,'41,55,'47,61. Cult'39,66. D'45,410'57,547. B'51,308,'83,383. Wg73. Cole157. HovII,45. AgR'53,280. E'54,336,'59,409. H190. A'62,70. T75, 267,'85,285,'97,464. MVHS'83,130. Syn. of Ghislain.									
Saint Ghislain. K'32,183,'41,151. GenF'33,197. MagofH'45,178. HovII,45. H190. D'69,850. Syn. of Ghislain.									
Saint Ghislain. F282. Syn. of Ghislain									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
St. Haye. R. Syn. Vannes de St. Haye									Published in Magazine of Horticulture, 1855, p. 146.
St. Herblain d'Hiver. MasH'46,151. MagofH'54,456. D'57,564,'69,751. F277. Syn. of Easter Bergamot.									
St. Herblain d'Hiver. E'59,410									Probably same as Easter Bergamot.
Saint Hubert Rousset. MagofH'43,131. Syn. of Hubert									
Saint Laure. F282. Syn. of Laure.									
St. Jean. E'54,366,'59,381. Syn. of Harvest									
St. Jean. D'45,330,'57,450,'69,658. F276. Syn. of Joannet									
St. Jean [illegible]. [illegible] E'54,381,'59,410. D'57,546,'69,727. Syn. of Flandre.									
St. Jean [illegible] d'Hiver. F282. D'69,727. Syn. of Flandre									
St. Jean Musque Gros. GenF'33,197. D'45,341,'57,578,'69,818. E'54,397,'59,423. F281. Syn. of Muscat Robert.									
St. Jo[illegible]. EFABC'00. Syn. of [illegible]									
St. John. [illegible]. Syn. of Harvest									
St. John's Pear. Pr9. E'54,366,'59,381. Syn. of Harvest									
St. John's Pear. Pr9. K'41,117. D'45,330,'57,450,'69,658. Syn. of Joannet									
Saint Joseph. F282. Syn. of Joseph.									
Saint Lambert. Pr152. K'32,128. GenF'37,277. D'45,337,'57,514,'69,758. E'54,373,'59,393. F280. T'75,555,'85,571,'97,714. Syn. of Jargonelle (Eng.)									
Saint Laurent. Pr83. D'69,757. Syn. of Jargonelle (Fr.)									
St. Lezain. Pr66. MagofH'38,296. Syn. of Lezin									
Saint Lezin. Pr66. D'69,850. Syn. of Lezin									
Saint Louis. F282. Hort'72,150	For.								Not described.
St. Luke. EFABC'00. Syn. of Luke.									
Saint Marc. D'69,658. Syn. of Thouars									
St. Marc. WHR1,47. E'54,342,'59,352. D'57,445,'69,871. Syn. of Urbaniste									
Saint Marcel. Pr79. K'32,142,'41,124. Syn. of Angelique									
St. Mark. F222. Syn. of Urbaniste									
St. Martial. Pr79. K'41,124. D'69,660. Syn. of Angelique									
Saint Martial. Pr79. Syn. of Angelique.									
St. Meare. F283. Syn. of Urbaniste									
Saint Menin. MasH'53,22. MagofH'54,87. D'57,549,'69,850. F282. E'59,410. AJof HVIII,222. T'75,555,'85,571,'97,714. Syn. of Menin.									
St. Mesmin. E'54,383,'59,410	Eur.	obl	l	yg	j		g-vg	m	Mr. Lyon believed this to be Menin.
St. Michael. Th192. Pr13. E'59,336. T'75,555,'85,571,'97,714. Syn. of White Doyenne.									
St. Michael Archange. K'41,152. E'54,384,'59,410. D'57,546,'69,851. T'75,267,'85,285,'97,464. Syn. of Archangel.									
St. Michael Archangel. MagofH'51,499. B'51,318,'83,383. HovI,71. Hort'54,310,'68,202,'75,244. AgR'54,245. D'57,546,'69,851. Syn. of Archangel.									

Saint Michel Archangel. HovI,71. F282. D'69,851. Syn. of Archangel									
St. Michael d'Ete. D'69,742. Syn. of Summer Doyenne									
St. Michael d'Hiver. D'57,431,'69,742. F241,279. E'59,335. AgR'66,133. T'85,310. Syn. of Alencon.									
St. Michael d'Hiver. E'59,364. Syn. of Gray Winter									
St. Michael (of Boston). C191. Cult'44,36. D'45,378,'57,436,'69,880. HovII,85. H190. Syn. of White Doyenne.									
St. Michael (of New England). AgR'50,95. Syn. of White Doyenne									
St. Michael's. Cult'39,66. L18. Syn. of Ghislain									
Saint Michael blanc. F279. Syn. of White Doyenne									
St. Michael. WPr9. GenF'33,196. IndF'40,182. K'41,121. D'45,378,'57,436,'69,880. HovII, 85. AgR'53,280. A'62,68. Syn. of White Doyenne.									
St. Michel Archange. K'41,152. D'57,546,'69,851. AgR'58,423. A'62,70. CanExFR-'04,479. Syn. of Archangel.									
Saint Michel Crotte. D'69,859. Syn. of Stevens									
St. Michel Dore. GenF'33,196. D'45,380,'57,437,'69,745. E'54,322,'59,335. F245,279. T'85 293. Syn. of Gray Doyenne.									
St. Nicholas. Cult'47,340. MagofH'49,107. Hort'51,114. E'54,364,'59,331. D'57,493, '69,749. H190. F229. AgR'63,125. T'97,714. Syn. of Orleans.									
Saint Pair. Pr113. Syn. of Saint Pere									
Saintonge. Pr82. Syns. Blanquet de Saintonge, Chat Brusle	For	p	ml	gru	m	sp	g	m	An old variety formerly populat in France.
St. Patrick. MassH'66,45	Mass								Originated at Brookline, Mass. Fruited in 1863.
Saint Pere. Pr113. K'32,149,'41,126. F282. Syns. De Pape, Holy Father, Poire de Saint Pere, Saint Pair.	For	p	m	gy	co			vl	Strictly a cooking variety.
Saint Pierre. MagofH'43,131. Syn. of Pierre									
Saint Quentin. R. Syn. Beurre de Saint Quentin	For	obtp	m						Originated by Mr. Noisette.
Saint Sampson. Pr152. D'45,337,'57,514,'69,758. E'54,373,'59,393. F280. Syn of Jargonelle (Eng.).									
Saint Sanson. Pr152. K'32,128. GenF'37,277. Syn of Jargonelle (Eng.)									
Saint Swithin. CanExFR'96,445,'98,400. BBL. EFABC'00. Syn. of Swithin									
St. Therese. MichH'75,87. Dap153. A'73,76. Agr'75,381	Fr	oblp	m	wyru	cojm	s	vg	m	Originated by Andre Leroy, Angers, France.
St. Vincent de Paul. MassH'62,32. GaH'93,54									Exhibited by P. J. Berckmans at meeting of Georgia Horticultural Society.
Saint Vincent de Paul. MagofH'57,303. D'57,547,'69,851. F282. E'59,410. T'75, 555,'85,571,'97,714. Syn. of Vincent.									
Salem. NWC'93	N. C								Published in N. W. Craft's catalogue for 1893.
Salisbury. L. Syn. Salisbury Seedling	N. Y	obtp		ru	cobr		g-p	me	Originated in western New York.
Salisbury Seedling. D'57,541,'69,851. F275. E'59,408. T'75,555,'85,570,'97,713 Syn. of Salisbury.									
Salomon. L. Syns. Grand Salomon, Louis Philippe	For								Published by Field, p. 280.
Salsburg. IaH'85,382. IndH'85,27	Rus								Recommended by Professor Budd.
Salviata. D'69,851. Syns. Epine Rose Gris, Forniquet, Perfumed, Salviate, Salviati.		obtp	ms	yru	brj	p	g	me	Now superseded by better varieties.
Salviate. H186. CanExFR'96,136. EFABC'00. Syn. of Salviata									
Salviati. R. Syn. Salviati de Provence		t		y	cobr	sm			Probably same as Salviata.
Salviati. C187. Pr32. K'32,131,'41,119. MagofH'43,131. Syn. of Salviata									
Salviati de Provence. Pr33. Syn. of Salviati									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Salzburg. Gb. MHSC'82,60. FGAofO'83,223. Syn. of Salzburger	Rus.								Imported from Russia in 1882; tree vigorous and hardy.
Salzburger. Gb. Syn. of Salzburg									
Sam Brown. A'69,101. AJofHVII,79. AHortA'70,77. AgR'75,379. Dap134. T'75, 554,'85,570,'97,713. Syn. Maryland Seedling.	Md	rob	ms	yrub	cojm	v	vg	me	Originated at Walnut Hills, Anne Arundel County, Md., with Sam Brown, jr.
Samenlose. IaH'85,382. IndH'85,27	Rus.								Mentioned by Professor Budd.
Samenlose. CanH'89,291. Syn. of Bessemianka									
Samoyeau. L. T'97,713. Syn. Buerre Samoyeau			m	yr	bj			m	
Sanborn Pear. OH'85,177. Syn. of Craig									
Sand Bergamotte. CanH'94,291	Rus.?		m				g		Uncertain as to identity.
Sandford. MagofH'38,77									Not described.
Sand Pear. D'69,851. IaH'75,213,'83,101'84,314. OH'81,21. IndH'79,48. GarM'84,19. T'85,570,'97,713. Syn. of Sha Lea.									
Sandwich Island Pear. IndH'78,64. CanH'79,95. B1229. MichB31. GaH'92,49. BBL. Syn. of Hawaii.									
Sanguine. Pr27. Syn. of Sanguinole									
Sanguine d'Italie. WPr12. Pr27. F282. D'69,851. Syn. of Sanguinole									
Sanguinole. Pr26. K'32,153,'41,119. F282. D'69,851. Syns. Blood, Bloody, Grenade, Poire d'Italie, Red Flowering, Sanguine, Sanguine d'Italie, Sanguinole de France.		r	sm	yb	jm		g	me	An interesting curiosity; fruit of no value.
Sanguinole (Belg.). L. Syn. Sanguinole de Belgique		ovp	m	grru				me	A curiosity with red flesh; not valuable.
Sanguinole de Belgique. D'69,852. Syn. of Sanguinole (Belg.)									
Sanguinole de France. F282. Syn. of Sanguinole									
Sannier. R. Syn. Sannier's Bergamot									In the experimental orchard at Agassiz, B. C.
Sannier's Bergamot. EFABC'00. Syn. of Sannier									
Sanner Pere. EFABC'00									In the experimental orchard at Agassiz, B. C.
Sans Pair. D'69,702. Syn. of Sanspareil									
Sanspareil. L. T'97,713. Syns. Bergamotte Sanspareil, Besi Incomparable, Bezy Sanspareil, Non-Pareil Bergamot, Nonpareille, Sans Pair, Sans Pareille.	Fr	p	l	ygb	gbjm	v	p	ml	Only valued for cooking.
Sans Pareille. D'69,702. Syn. of Sanspareil									
Sanspeau. C180. D'45,345,'57,542,'69,856. B'51,301. E'54,383,'59,350. F282. T'85,270. Syn. of Skinless.									
Sans Pepins. Cult'47,340. MagofH'50,286. A'54,239. D'69,778. Syn. of Hampden.									
Santa Ana. WnI,332,II,341. A'95,68. IllH'96,204. BBL. EFABC'00	Cal	obp	l	yru	t	vp	g	l	Originated in Santa Ana, Cal.
Santa Rosa. L. Syn. Santa Rosa Seedling	Cal	p	l		b	v		m	
Santa Rosa Seedling. WnI,332,II,341. A'95,68. Syn. of Santa Rosa									
Santellet. L. Syns. Doyenne Santelete, Doyenne Santellet, Sentilet	Fl	obtp	ml	gyru	gd	p		m	From Flanders; described by Lindley.

Sapeller. R. Syn. Beurre Sapelier.	For.		m		mj		vg		Said in 1864 to be promising.
Sapianski. A'54,239									Rejected by Congress of Fruit Growers, 1849.
Sapiega. FGAofO'96,87. Syn. of Sapieganka									
Sapieganka. Gb. FGAofO'83,221,'92,101,102,'96,26. MHSC'82,56,'83,118. A'83,74,'87,94. IaH'84,316,'85,321. OH'87,165. CanH'85,39,90,238. AofH'90,203. Syns. Autumn Polish Bergamotte, Bergamot Sapieganka, Courland Bergamot, Round Bergamot, Sapiega, Sapreganka.	Rus.?		m						Brought to America in 1879.
Sapin. Pr29. K'41,118. MagofH'43,131. Syn. of Coquillard		p	s	gy	cod	p		ve	
Sapreganka. IHH'90,126. Syn. of Sapieganka									
Sarah. AJofHHI,23. MassH'67,37,'69,10,'74,153. D'69,852. A'69,50,100. AHortA-'69,80. FGAofO'69,44. E&B'94. AHM261.	Mass.	robop	m	gyru	djm	sp	vg	m	Raised by Thaddeus Clapp, of Dorchester, Mass.
Sarah. D'57,564,'69,784. F277. Syn. of Hollande									
Sarah Clapp. HAJ'88,74									Probably the same as Sarah.
Sarasin. DomEncIV,179,190. Th189. K'41,126. EFABC'00. Syns. Sarazin, Sarrazin.	Fr.	obl	l	gyr	m	sp		vl	Said to keep one year or more.
Sarazin. MagofH'37,51,'43,129. Syn. of Sarasin									
Sarrazin. Pr121. Syn. of Sarasin									
Saterthwaith. R. Syn. Saterthwaith's Early									Cultivated by Silas Wharton in 1824.
Saterthwaith's Early. SW. Syn. of Satherthwaith									
Satin. Pr115. K'32,137,'41,121. D'69,797. Syn. of Lansac									
Satin Green. GenF'37,277. Syn. of Cuisse Madame									
Satin Vert. GenF'37,277. Syn. of Cuisse Madame									
Satin Vert. Pr115. Syn. of Lansac									
Satin Vert. D'45,346,'57,573,'69,758. Syn. of Summer Thorn									
Satin Vest. Pr28. E'54,399,'59,424. Syn. of Summer Thorn									
Sauch. MagofH'43,131									Not described.
Saumur. L. Syns. Beurre Seeringe, Doyenne de Saumur		rov	ms	y	jm	s	g vg	me	
Saunders. R. Syn Saunders Beurre	For.								Cultivated by Thomas Saunders, Salem, Mass.
Saunders Beurre. MagofH'37,47. MassH'37,37. Syn. of Saunders									
Saunier. R. Syn. Louise Bonne Saunier		oblp	s	y	j	v	g	m	In the experimental orchard at Agassiz, B. C.
Sauvage. R. Syn. Sauvage d'Angleterre									Not described.
Sauvage d'Angleterre. MagofH'43,131. Syn. of Sauvage									
Sauvageon Lant. K'32,179,'41,149. GenF'37,277. Syn. of Napoleon									
Savinier. L. Syn. Napoleon Savinier	Fr.	obop	m	yru	cojm		g	l	Resembles Napoleon, but matures later.
Savory. R. Syns. La Savourese, La Savoureuse, Savoury	Ger.?	rob	s	gru	b	s		l	Described by Verger.
Savoury. DomEncIV,186. Syn. of Savory									
Scarlet. MagofH'43,131									Not described.
Scented. Gb. IaH'85,323. CanExFR'96,136. Syn. Duchovaya	Rus.								Introduced from Russia in 1882.
Schabin Ghryrey. MagofH'57,303. Syn. of Ghryrey									
Scheidweiler. L. T'97,714. Syns. Beurre Scheidweiler, Grosse Sucre		obp	m	gru	b	s	g	m	
Schelis. D'69,863. Syn. of Bon Chretien (Sum.)									
Schenck's August. Cult'53,316. CGenH,170. Syn. of Hosenschenck									
Schenck's August Watermelon. E'54,372,'59,391. Syn. of Hosenschenck									
Schenck's Pear. E'54,372,'59,391. Syn. of Hosenschenck									
Schenk. MagofH'54,24. Syn. of Hosenschenck									
Schenk August. R. Syn. Schenk's August									Probably the same as Hosenschenck.
Schenk's August. Hort'54,380. Syn. of Schenk August									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Schman. Hort'58,527									Not described.
Schooling Merry. MassH'47,69. Syn. of Schooling Merry									
Schooling Merry. MassH'48,99. Syn. Schooling Merry									In Robert Manning's collection, 1848.
Schone and Gute. Pr128. K'32,160,'41,135. GenF'37,277. D,45,353,'57,454,'69,778. MagofH'47,344. F'276. Syn. of Hampden.									
Schuman. D'69,852	Pa	robo	m	yr	co		p	m	Not desirable.
Schuylkill. R. Syn. Schuylkill Seedling	Pa.?								Growing on the farm of Mr. Harmer, Grays Ferry, Pa.
Scieulle. WHRI,65. Syn. of Sieulle									
Scooter. AJofHV,179									Probably local on Long Island.
Scotch Bergamot. D'45,333,'69,778. F277. T'75,554,'85,570,'97,714. Syn. of Hampden.									
Scouman. L. Syn. Florent Scouman		p	l	gsbr	djm	s		ml	From the Society of Van Mons.
Sdegnata. F282	For.								Not described.
Seal. D'69,852	Pa	r	ms	yc	cojm	a	g	me	
Seatin. R. Syn. Seatin Beurre									Not described.
Seatin Beurre. MagofH'39,395. Syn. of Seatin									
Sebastopol. D'69,852. Syn. Sebastopol d'Ete	Belg	ovobo	m	gy	dmg	svp		me	
Sebastopol d'Ete. D'69,852. Syn. of Sebastopol									
Sec. L. Syns. Dry Martin, Martin Sec, Martin Sec de Champagne, Martin Sec d'Hiver, Martin Sec de Provence, Rousselet d'hyver, Rousselette d'Hiver, Troken Martin, Winter Rousselet, Winter Rousselette.		ova	s	yeru	cogj			l	
Seckel. WPr9. Pr139. K'32,183,'41,152. Cult'42,166,'44,37. M'44,57,'47,63. D'45,415,'57,443,'69,852. IndF'40,56. Cole162. Hort'49,34. B'51,308,'83,373. HovII,33. Wg73. MagofH'53,457. E'54,335,'59,347. G84. H186. F204. Q14,56. S90. F152. Bl228. Bul6,8. T'75,278,'85,296,'97,473. WnI,325,II,335,III,258. Syns. New York Red Cheek, Red Cheeked Seckel, Seckle, Shakespeare, Sickel, Sickle, Syckle, Sycle.	Pa	obo	s	ybru	bjm	v	b	me	Mr. Downing pronounced it the best pear known.
Seckle. C189. Th189. SW. Pr139. GenF'33,197. M'38,73. Cult'39,66. D'45,415,'57,443,'69,852. HovII,33. CGenIX,225. E'54,335. Syn. of Seckel.									
Secretary Alfred Vigneau. EFABC'00. Syn. of Vigneau									
Seedless. Gb. IaH'85,321. CanH'89,291. MichH'92,166. Syn. of Bessemianka									
Seedless. CGenVIII,272. AHM239. Syn. of Cole (Kan.)									
Seedless. K'32,182. Syn. of Hampden									
Seedling Seckel. NAPC'49,18. MagofH'50,112. E'54,329,'59,341. AgR'65,189. Syn. of Kirtland.									
Seedling Seckel. A'60,121. Syn. of Woodbridge									
Seedling Virgalieu, No. 4. MassH'74,158. Syn. of Christmas Beurre									
Seigler. MichH'76,143									Not described.
Seigneur. NWFG'55,41. D'69,762. Syn. of Lucrative									
Seigneur d'Esperin. B'51,318. E'54,312,'59,325. D'57,439,'69,762. H187. F194,276. Syn. of Lucrative.									

Seigneur d'Ete. Pr194. K'32,157,'41,133. GenF'37,277. EFABC'00. Syn. Lord of Summer.		ovobl	ml	yc	m		p	me	
Seigneur d'Hiver. GenF'33,198. K'41,160. D'45,425,'57,428,'69,751. E'54,317,'59,331. F214. T'85,310. Syn. of Easter Beurre.									
Seigneur Tachete. K'41,170. MagofH'42,250. Syn. of Tachete									
Seiville. IllH'93,106									Exhibited at Springfield, Ill.,1893.
Selleck. Hort'56,510,'57,115. MagofH'57,114. D'57,543,'69,854. F275. E'59,409. A'60,98. CGenIX,191. T'75,267,'85,285,'97,464.	Vt.	obtp	l	ycru	cojm	sp	g-vg	m	Found on the grounds of C. Selleck, Sudbury, Vt.
Semlianitchnaya. Gb. Syn. of Strawberry									
Senateur Belle. EFABC'00									In the experimental orchard at Agassiz, B. C.
Senateur Mosselman. D'69,854. Syn. of Mosselman									
Senateur Vaisse. EFABC'00. Syn. of Vaisse									
Seneca. WmP'92. C(O)HS'92,130. AofH'92,185. JSC'95. CBCo'95. IllH'96,178,'98,180. AHM263.	N. J.?								Introduced by William Parry in 1892.
Sentilet. E'54,363,'59,378. Syn. of Santellet									
September Orange. K'32,140,'41,127. Syn. of Orange Sept									
Sept-en-gueule. Pr10. K'32,129. D'45,340,'57,577. F281. Syn. of Little Muscat									
Seraphine Ovin. D'69,854. Syn. of Ovin									
Seraphine Ovyn. MagofH'57,303. MassH'62,32. Syn. of Ovin									
Serrurier. MagofH'51,550,'55,186. E'54,383. D'57,543,'69,854. F282. Hort'61,318. CGenXXV,94. T'75,279,'85,297,'97,474. Syns. Belle Alliance, Fondante de Millat, Fondante de Millot, Fondante Serrurier de Millat, Neufmaisons, Neuve Maison, Nouveau Maison, Nouveau Mauxion, Poire Serrurier, Serrurier d'Automne.	Belg.	robt	m	yrru	cojm	va	g-vg	m	Originated by Dr. John Van Mons.
Serrurier d'Automne. K'32,184,'41,152. MassH'48,99. E'54,383,'59,383. D'57,543,'69,854. F281,282. Syn. of Serrurier.									
Seutin. D'69,854. Syn. Poire Seutin	Belg.	ov	ml	gbru	mj	sp		m	Raised by M. Bouvier.
Shakespeare. Cult47,340. HovII,33. D'69,852. Syn. of Seckel									
Sha Lea. IndH'78,63,'79,48. IaH'79,302. GarM'84,19. Bl229,244. Syns. Chinese Sand Pear, Sand Pear, Sha-li.		rp	m	yru	j			m	The supposed parent of the Kieffer.
Sha-li. IaH'81,376. Syn. of Sha Lea									
Shaumontel. D'69,718. Syn. of Chaumontel									
Shawl. MassH'48,101. Syn. of Durfee									
Shaw-Montel. D'69,718. Syn. of Chaumontel									
Shawmut. MagofH'59,209. A'67,158. D'69,855. MassH'82,38. Syn. Dana's No. 17	Mass.	obtp	l	yru	comj	vp		m	Originated with Francis Dana, Roxbury, Mass.
Sheldon. MagofH'50,499,'51,252,'53,542. Hort'51,52. HovII,61. E'54,383,'59,347. D'57,444,'69,855. H186. F256. S90. Fi52. Q60. B'83,373. Bl228. T'75,284,'85,302,'97,477. WnI,327,II,337. Syns. Bland, Black Virgalieu, Huron, Penfield, Wayne, Whipple, Wisner.	N. Y.	robt	ml	gycru	jm	svp	vg	m	Found on the farm of Norman Sheldon, Huron, N. Y.
Shenandoah. MassH'66,43	Mass.								Raised by Dr. S. A. Shurtleff, Brookline, Mass. Fruited in 1862.
Shenck's August. MagofH'53,462. Syn. of Hosenschenck									
Shenk's. MagofH'52,162,198,'51,23. D'45,413,'57,508,'69,784. Hort'54,400. H188. AJofHVIII,223. T'75,555,'85,570. Syn. of Hosenschenck.									
Shepard. Cult'54,345. CGenIV,250. T'75,279,'85,297,'97,474. Syn. of Sheppard									
Shepard's Seedling. T'85,297. Syn. of Sheppard									
Shephard's Seedling. MagofH'55,184. A'56,38. Hort'57,214. Syn. of Sheppard									
Shepherd. MassH'56,19. F275. MagofH'58,509. Syn. of Sheppard									
Sheppard. D'57,583,'69,855. E'59,408. AHortA'70,77. Syns. Dorchester Seedling, Shepard, Shepard's Seedling, Shephard's Seedling, Shepherd.	Mass.	ovp	l	ybru	cogjm	vp	g-vg	m	Correct spelling of the name uncertain.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Sheridan. MassH'66,44	Mass.								Raised by Dr. S. A. Shurtleff, Brookline, Mass. Fruited in 1864.
Shindel. P'95,38. A'97,44	Pa.?	robo	m	yru	gj	s	g	me	Sent from Emigsville, Pa., by J. A. Stahle.
Shiri-yuki. AofH'91 296									Not described.
Shobden. L. Syn. Shobden Court	Eng								Raised by Dr. Thomas A. Knight; not described.
Shobden Court. MagofH'40,46,'43,129,'50,498. K'41,165. MassH'45,88. A'54,239. Syn. of Shobden.									
Short's Saint Germain. D'45,347,'57,582,'69,864. E'54,399,'59,424. F282. Syn. of St. Germain (Sum.).									
Shurtleff. E'54,384,'59,408. F275. MassH'66,44. Syn. Shurtleff's Seedling	Mass	robo	m	gyru	comj			me	Originated by Dr. S. A. Shurtleff, Brookline, Mass.
Shurtleff's Seedling. MagofH'48,109,343. E'54,384,'59,408. AHortA'68,81. Syn. of Shurtleff.									
Sibour. L. Syn. Monseigneur Sibour	Fr	obtp	m	ygcr	mj	s		ml	
Sicile. D'69,758. Syn. of Jargonelle (Eng.)									
Sickel. D'45,415,'57,443,'69,852. T'75,555,'85,570,'97,714. Syn. of Seckel									
Sickle. E'54,335,'59,347. Syn. of Seckel									
Sickler. MagofH'50,296									Rejected by Congress of Fruit Growers, 1849.
Siebold. R. Syns. Mme. Von Siebold, Madame von Siebold Sieboldii, Von Siebold.	Jap.?								An Oriental variety; probably of no value.
Sieboldii. OH'88,103. Syn. of Siebold									
Siegneur d'Esperin. WHRIV,164									Published in Western Horticultural Review, April, 1854, p. 164.
Siegneur d'Hiver. AgR'62,180. Syn. of Easter Beurre									
Sieulle. Pr151. K'32,184. GenF'33,197. Cult'39,66. D'45,413,'57,435,'69,746. B'51, 310. Wg73. HovI,17. E'54,363,'59,378. H188. F240. AgR'65,190. AJofHVII,234. CGenXVI,368. T'75,295,'85,313,'97,485. MHSC'76,30. Syns. Beurre Sieulle, Burgamotte Sieulle, Doyenne d'Hyver, Doyenne Scieulle, Doyenne Sieulle, Scieulle.	Fr.?	rob	m	gycr	cobj	vp	g	m	Originated with M. Sieulle.
Signoret. Hort'54,305. E'54,383'59,409. Syn. Sagaret	For	rov	ms	gy	co		g	m	
Silliman's Russet. D'57,572,'69,833. F275. MagofH'59,399. Syn. of Pinneo									
Silvanbirne. D'69,866. Syn. of Sylvange									
Silvange Pierard. D'69,866. Syn. of Sylvange									
Simon. F282	For								Not described.
Simon Bouvier. D'57,543,'69,856. F282. T'75,555,'85,570,'97,714. Syn. Souvenir de Simon Bouvier.	Belg	obtp	ml	ycru	bmj	sp		m	Originated with M. Gregoire in 1833.
Sincinus. OH'74,12									Probably a misprint for Cincincis.
Sinclair. L. Syn. Sinclair's Seedling	Md		s				vg		Originated with Mr. Sinclair, of Baltimore, Md.

Sinclair's Seedling. WHRIV,164. H187. Syn. of Sinclair									
Sire. L. Syns. Certeau Musque d'Hiver, Martin Sire, Ronville, Sire Martin		t	l	gyr	cogj	s		vl	Only valued for cooking.
Sire Martin. D'69,814. Syn. of Sire									
Sirentz. R. Syns. Citron de Sirentz, Sirenz									Rejected by Congress of Fruit Growers, 1849.
Sivenisher. EFABC'00. CanExFR'01,547		robo	ms	gy	jm	s	g	m	In the experimental orchard at Agassiz, B. C.
Sirenz. MagofH'43,130. Syn. of Sirentz									
Sisters. L. Syns. Des Deux Soeurs, Deux Soeurs, Poire de deux Soeurs, Poire Duex Soeurs, The Two Sisters.	Fr.	oblov	m	gy	coj	s	g	m	
Six. L. T'97,714. Syns. Beurre Six, Poire Six	Belg.	p	ms	gy	jm	v	g	me	
Skinless. GarCal587. C180. Th191. WS. WPr10. Pr138. K'32,131,'41,119. M'38, 66,'44,52. Cult'42,166. D'45,345,'57,549,'69,856. B'51,301. E'54,383,'59,350. H188. F282. T'75,252,'85,270,'97,653. Syns. Early Rousset, Early Ruselet, Fleur de Guignes, Flower of Guignes, Fruhe Rousselet, Poire Sans Peau, Precoce de Glady, Rousselet Hatif, Sanspeau.		p	ms	gyr	jm	sp	g	me	Has a remarkably smooth and thin skin.
Skinless. Pr16. Syn. of Blanquet (Long Stem)									
Slightinger. R. Syn. Marie Louise Slightinger									Published in Magazine of Horticulture, 1855, p. 146.
Slutsk. FGAofO'92,109. Syns. Beurre Slatzsk, Beurre Slutsk, Buerre Slutzsk	Rus.		m	gy				l	Originated in Minsk, Russia.
Small Blanquet. Pr17. D'69,802. Syn. of Little Blanquet									
Small Cassolette. Pr31. K'32,127. Syn. of Cassolette									
Small Catharine. SW									Cultivated by Silas Wharton in 1824.
Small Summer Thorn. Pr28. Syn. of Summer Thorn									
Small Winter Beurre. D'69,700. Syn. of Caissoy									
Small Winter Butter Pear. Pr125. K'32,143. Syn. of Caissoy									
Smet. L. Syns. Charles Smet, Charles Smit, Charles Smith	Belg.	p	m	yru	j	sp	g-vg	vl	Originated by Dr. John Van Mons.
Smith. GaH'91,31. IHH'92,323. GLT'01. AHM264. Syns. Smith s, Smith's Hybrid.									An Oriental variety grown in the South.
Smith's. PJB'94. GHM&S'94. GaH'90,23,'91,53. Huc'01. Syn. of Smith.									
Smith's Bordenave. MegofH'47,450,'50,498,'51,256,436. Hort'51,116. E'54,356,'59,343. D'57,520,'69,803. A'62,70. AHM254. T'75,555,'85,570,'97,714. Syn. of Lodge.									
Smith's Duchess. IaH'83,101. [Prof. Budd said it belonged to the Asiatic group].									
Smith's Early Butter. MagofH'47,274,'49,340. D'69,818. Syn. of Moyamensing									
Smith's Haddington. MagofH'47,274. E'54,371,'59,387. Syn. of Haddington									
Smith's Hybrid. GaH'85,49,'87,49. GMH&S'90. AofH'92,277. PaB18. PH'94,80. IndH'92,93. EWK'01. Syn. of Smith.									
Smith's Moyamensing. Hort'47,494. MassH'47,90. B'51,300. K'54,332,'59,399. Syn. of Moyamensing.									
Smith's Pennsylvania. MagofH'43,437,'44,213. MassH'44,60,'47,90. D'45,404,'57,579, 69,832. AJofHIX,86. Syn. of Pennsylvania.									
Smith's Superior. Dap155. Syn. of Windsor									
Smokehouse. Hort'53,458. E'54,372,'59,391. D'57,508,'69,784. Syn. of Hosenschenck.									
Smolensk. FGAofO'91,14. Syn. of Thin Twig									
Smyth. R. Syn. Miss F. Smyth	Eng.								Thought to be a seedling of Bartlett, but later.
Snow. R. Syns. Pei-li, Snow Pear	Iowa			w					Originated with Suel Foster Muscatine, Iowa.
Snow Flower. D'57,500,'69,782. F280. E'59,384. T'75,546,'85,561,'97,702. Syn. of Henri Van Mons.									
Snow Pear. IaH'73,149,'79,303,'81,376. HAJ'88,47. GaH'91,31. Syn. of Snow									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Snow Pear. GenF'33,196. D'45,378,'57,436. HovII,85. E'54,322,'59,336. F224. AgR-'62,183. Syn. of White Doyenne.									
Snyder. IllH'03,272									In the trial orchards of Illinois experiment stations.
Sobden Court. F278. Syn. of Broom Park									
Sobieski. R. Syn. King Sobieski		obtp	m	yr	j	sp	g	me	In the experimental orchard at Agassiz, B. C.
Socquet. F282	For.								Not described.
Soeur. L. Syns. La Soeur Gregoire, Soeur Gregoire	Fr.	obl	l	yr	mbj	sp		l	Raised by M. Gregoire.
Soeur Gregoire. D'69,798. EFABC'00. Syn. of Soeur									
Soldat. L. Syns. Alphonse Karr, Auguste Van Kraus, Beurre de Rhine, Blumenbach, Brabant, Duchesse de Brabant, Esperin Soldier, Soldat d'Esperen, Soldat Esperen, Soldat Laboreur, Soldat Laboreur d'Esperin, Soldat Laboreur (of the French), Soldat Laboureur.	Belg.	obop	lm	yru	gm	svp	g-vg	m	A seedling of Maj. Esperen. Fruited in 1820.
Soldat. F277. Syn. of Easter Bergamot									
Soldat d' Esperen. MagofH'48,210. E'54,337. Syn. of Soldat									
Soldat Esperen. H189. D'69,856. Syn. of Soldat									
Soldat Laboreur. Hort'51,116. MagofH'54,139. AgR'54,245. F257. T'75,267,'85,285,'97,464. Syn. of Soldat.									
Soldat Laboreur d' Esperin. E'54,337,'59,349. H189. Syn. of Soldat									
Soldat Laboreur (of some). HovI,1. E'54,314,'59,326. AgR'65,188. Syn. of Aremberg.									
Soldat Laboreur (of the French). H189. Syn. of Soldat									
Soldat Laboureur. Cult'47,340. MagofH'48,210. Hort'52,14. AgR'56,368. D'57,543,'69,856. T'85,285. Syn. of Soldat.									
Soleil. L. Syns. Grand Soleil, Grand Soliel	Belg.	rp.	m	yeru	cojm	sv	vg	m	Introduced by Maj. Esperen, of Malines.
Soleurs. D'69,706. Syn. of Soulers									
Solitaire. Pr62. K'41,122. D'57,577,'69,661. Syn. of Angobert									
Solitary Mansuette. Pr62. Syn. of Angobert									
Sommer Apothekerbirne. D'45,346,'57,583,'69,863. F282. Syn. of Bon Chretien (Sum.).									
Sommer Gute Christbirne Grosse. Pr59. Syn. of Bon Chretien (Sum.)									
Sommer Gute Christenbirne. D'45,346,'57,583,'69,863. F282. Syn. of Bon Chretien (Sum.).									
Sophia. L. T'97,714. Syns. Beurre Sophia, Bonne Saplier, Bonne Sophia		ap	m	gyeru	djm	sp	vg	m	
Sophia Beekmans. D'69,814. Syn. of Marie Parent									
Sorlus. F282. Syns. Bergamotte de Soulers, De Sorlus	Belg.	oblp	ml	gyru	co		g	m	Raised by Dr. John Van Mons.
Sotschuaja. IaH'80,61	Rus.								Not described.
Sou de la Mare au Trou. HAJ'88,74. Syn. of Trou									
Soulange. L. T'97,464. Syns. Beurre Soulange, Doyenne Soulange		ap	ml	yru	mj	sp		m	Mentioned by Col. M. P. Wilder in report.

Soulard. R. Syn. Soulard's Bergamot	Mo								Said to have been originated at St. Louis, Mo., by J. G. Soulard.
Soulard's Bergamot. Hort'51,476. Syn. of Soulard									
Soulers. L. Syns. Bergamotte de Soulers, Bergamotte of Soulers, Beurre de Paques, Beurre de Soulers, Bonne de Soulers, De Soulers, Soleurs.		ov	m	gyr	jm	sv	g	vl	Described in 1675.
126 **Souvenir.** Bul6,8. Syns. Poire du Congres Pomologique, Souvenir de Congres, Souvenir du Congres, Souvenir (Cong.), Souvenir du Congress.	Fr	oblp	l-vl	yeru	gbj	vp		me	Originated by M. Morel, Lyon-Vaise, France.
Souvenir (Belg. Queen). L. Syn. Souvenir de la Reine des Belges	Belg	ap	ml	yeru	dmj	sp		m	Raised by M. Gregoire.
Souvenir de Congres. MassH'72,92. Syn. of Souvenir									
Souvenir d'Esperen. AJofHVI,14. AHortA'68,81,'69,75. AgR'75,380. T'75,267,'85,285,'97,905. D'69,857. B'83,383. Syn. of Souvenir (Esp.).									
Souvenir de la Reine des Belges. D'69,857. Syn. of Souvenir (Belg. Queen)									
Souvenir de Lens. WNYH'05,140									Exhibited by Ellwanger & Barry at meeting of Western New York Horticultural Society, 1905.
Souvenir de Leroux Durand. EFABC'00. Syn. of Leroux									
Souvenir de Madame Treyve. MassH'62,32. D'69,809. Syn. of Treyve									
Souvenir de Rouen. FGAofO'83,72									Not described.
Souvenir de Simon Bouvier. F282. D'69,856. Syn. of Simon Bouvier									
Souvenir du Congres. GarM'72,250. AgR'75,381. MichH'75,89. WnI,335,343. Syn. of Souvenir.									
Souvenir du Congress. Hort'69,234,'72,322,'73,313. D'69,856. IaH'73,89. MichH'74,266. T'75,555,'85,570,'97,714. B'83,365. WnI,325,II,335,III,258. HB'03,135. Syn. of Souvenir.									
Souvenir du Venerable de la Salle. EFABC'00. Syn. of Venerable									
Souvenir (Esp.). L. Syn. Souvenir d'Esperen	Belg	oblp	l	gyru	j	vp	vg	m	Raised by Maj. Esperen.
Souvenir Esperen. F276. Syn. of Noel									
Souvenir Favre. D'69,858. Syn. of Favre									
Souvenir Favre. Dap134. Syn. of Favre (Souv.)									
Souvenir Saumir. NJH'89,214									Said not to be promising.
Souvenir Trayve. FGAofO'83,72									Not described.
Souverain d'Ete. E'59,379. Syn. of Berri									
Souveraine. GenF'33,197. D'45,444,'69,829. A'54,239. E'54,380,'59,403. Syn of Passe Colmar.									
Souveraine d'Ete. MassH'51,189. E'54,384. D'57,545,'69,858. F282. H192. T'75,555,'85,570,'97,714. Syn. of Sovereign (Sum.).									
Souveraine d'Hiver. K'41,165. D'57,532,'69,829. F254. T'75,555,'85,570,'97,714. Syn. of Passe Colmar.									
Souveraine de Printemps. D'57,544,'69,858. F282. E'59,409. T'75,555,'85,570,'97,714. Syn. of Sovereign (Spring).									
Sovereign Colmar. Pr?15. Syn. of Passe Colmar									
Sovereign (Spring). L. Syns. Poire de Printemps, Souveraine de Printemps	Fr	robop	m	gyru	jm	s	g vg	m	
Sovereign (Sum.). L. Syns. Souveraine d'Ete, Souvraine d'ete		robop	ms	yeru	jm	svp	g	me	
Sovraine d'Ete. Hort'51,115. Syn. of Sovereign (Sum.)									
Sovreine. MagofH'50,296									Rejected by Congress of Fruit Growers, 1849.
Spae. L. Syn. Beurre Spae	Belg	rp	l	yb	jdm	sp	vg	m	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Spanish. L. Syns. Amande Suede, Autumn Bon Chretien, Blanche, Bon Chretien d'Automne, Bon Chretien d'Espagne, Bon Chretien dore d'Espagne, Bon Chretien Jaune d'Automne, Bon Chretien Spanish, Bon Chretien Spina, Compagnie d'Ostende, De Janvry, Good Christian of Spain, Gracioli de la Toussaint, Gratioli d'Automne, Grosse Grand Bretagne, Grosse Grand Bretagne Doree, Janvry, Mansuette, President d'Espagne, Safran d'Automne, Safran Rosat d'Automne, Spanish Bon Chretien, Spanish Warden, Spina, Vandyck, Van Dyck Vermillion d'Espagne d'Hiver	....	p	l	yr	cob	....	g	l	A very old variety; prized only for cooking.
Spanish Bon Chretien. GarCal587. WPr11. Pr'93. WS. K'32,140,'41,122. GenF'33,197. MagofH'37,50. MassH'44,64. D'45,430,'57,567,'69,858. APC'50,11. E'54, [illegible] H189. T'75,441,'85,556,'97,695. Syn. of Spanish									
Spanish Warden. D'69,858. Syn. of Spanish....									
Spar. LIABC'00									In the experimental orchard at Agassiz, B. C.
Sparbirne. AofH'92,272..									Not described.
Sparbirne. D'69,758. Syn. of Largonelle (Eng.									
Spate Hardenpont. AofH'91,296.									Not described.
Speckled Harris. D'69,779. Syn. of Harris....									
Speedwell. MassH'66,43......	Mass..								Originated at Brookline, Mass. Fruited in 1863.
Spel-bairgh. Wg74. Syn. of Spoelberch..............									
Spence. L. T'97,714. Syn. Beurre Spence	Belg..	tp	m	gyeru	jm	v	g-vg	m	Originated by Dr. John Van Mons.
Spice. MagofH'53,566. AgR'54,273. A'54,84. Syn. of Bleecker.....									
Spice. MagofH'49,43. Cult'39,66. Syn. of Rheims....									
Spice Butter. MagofH'53,566. AgR'54,273. A'54,85. D'57,567,'69,703. E'59,368. Syn. of Bleecker.									
Spice Catharine. K'32,137. Syn. of Summer Thorn..............									
Spice or Musk Pear. C186. Pr20. D'45,343,'57,581,'69,846. E'54,399,'59,424. H189. F282. T'75,555,'85,571,'97,714. L18. Syn of Rheims.									
Spicy Muscadel. DomEncIV,187		r	s	yb			g	e	
Spielman. IllH'96,187									On trial at Illinois experiment stations.
Spina. D'45,450,'69,858. E'54,391,'59,418. Syn. of Spanish..............									
Spina di Carpi. D'69,848. Syn. of Royal Winter..............									
Spoelberch. Wg74. Syns. Beurre de Spoelberg, Bezi de Spoelberch, Delices Van Mons, De Spoelberg, Despoilberg, Spel-bairgh, Vicompte de Spielberg, Vicomte de Spoelberch, Vicomte de Spoelberg.	Belg....	rp.	m	yru	bjm		g	ml	Raised by Dr. John Van Mons; described in 1830.
Sponge. D'57,481,'69,721. Syn. of Clay...									
Sportsman. D'69,735. Syn. of Chasseurs.....									
Spreuw. L. Syns. Fausse Spreaw, Fausse Spreuw..............									Published by Magazine of Horticulture, 1842, p. 250.

Sprin. R. Syn. Beurre Sprin									Published by Magazine of Horticulture, 1850, p. 526.
Spring Beurre. D'69,875. Syn. of Verulam									
Springfield. AgR'75,380. Syn. Primrose	D. C.								Originated by John Saul, Washington, D. C.
Squash. Th191. Syn. of Taunton									
Stanford Pear. OH'85,177. Syn. of Craig									
Stappaerts. R. Syn. Beurre Stappaerts									Published in Magazine of Horticulture, 1855, p. 150.
Staquet. L. Syn. Joseph Staquet	Belg.	oblp	ml	ygru	mbj	sp		m	Described in Annals of Pomology.
Stark. IllH'96,204									On trial at Illinois experiment stations.
Star of Bethlehem. Hort'69,334. AHortA'70,77. CalB147. Syn. of Bethlehem									
Staunton. GenF'33,196. D'45,366,'57,457'69,769. HovII,77. E'54,369,'59,384. F277. Syn. of Gansel Bergamot.									
Steinmitz. L. Syn. Steinmitz Catherine	Pa	oblp	ms	gb	jm	v	g	me	
Steinmitz Catherine. D'69,858. A'99,15. Syn. of Steinmitz									
Steinmitz Spice. D'69,859. A'99,15	Pa	rp		gyru	jm	sp	g	me	
Stephen's Genesee. D'45,412,'69,859. E'54,338,'59,351. Syn. of Stevens									
Sterkmans. L. T'97,465. Syns. Belle Alliance, Beurre Sterckmans, Beurre Sterkmans, Calebasse Sterckmans, Doyenne Sterkmans.	Belg.	obp	m	geru	djm	svp	g-vg	m	
Sterkman's Beurre (erroneously). D'57,466. Syn. of Hardy									
Sterling. MagofH'47,443. AgR'54,245,'56,381. E'54,384,'59,410. Hort'55,64. D'57,545,'69,859. F275. A'51,156,'62,70,122. Bul6,8. AHortA'68,81. T'75,279,'85,297,'97,474. AHM264. Syn. De Mott.	N. Y.	rovp	m	yeru	cojm	s	g-vg	me	Originated in Livingston County, N. Y.
Stevens. L. Bul6,8. Syns. Beurre des Belges, Doyenne Crottee, Doyenne Galeux, Genesee, Guernsey, Louise de Prusse, Passatutte, Passa-tutti, Philip Strie, Saint Michel Crotte, Stephen's Genesee, Stevens' Genesee.	N. Y.	r	l	y	b	p	g-vg	me	Originated by F. Stevens, Lima, N. Y.
Stevens' Genesee. Pr145. K'41,145. Cult'42,166. MagofH'42,61,'49,346. M'44,88. D'45,412,'57,545,'69,859. NAPC'49,38. Cole157. B'51,308,'83,373. Wg74. AgR'54,293. E'54,338,'59,351. T'75,285,'85,308,'97,478. A'62,70. AHM264. Syn. of Stevens.									
Stockett. AgR'75,381									From John Saul, of Washington, D. C.
Stoeppert. OH'65,41. Syn. Beurre Stoeppert									Probably same as Stappaert.
Stoffel. R. Syn. Stoffel's									Published in Magazine of Horticulture, 1840, p. 129.
Stoffel's. MagofH'43,129. Syn. of Stoffel									
Stone. MagofH'43,21. WHRIV,204. D'57,581,'69,860. H191. F275. T'75,555,'85,571,'97,714. Syn. Stone (of Ohio).	Ohio	rp	l	y	b	a	.....	me	Probably identical with Clemsford.
Stone. E'54,293,'59,420. Syn. of Clemsford									
Stone (of Ohio). MassH'46,153. Syn. of Stone									
Stout. P'95,39. A'97,44. IndH'98,100	Ind.	obtp	l	gy	bmj	sa	vg	m	Originated at Monrovia, Morgan County, Ind., about 1840.
Strange. R. Syn. Tom Strange									In Benjamin Buckman's collection, Farmingdale, Ill.
Strawberry. Gb. IaH'81,376. Syns. Kuang-li, Semlianitchnaya	Rus.								Introduced from Russia in 1879.
Stresa. R. Syn. Belle de Stresa									In the experimental orchard at Agassiz, B. C.
Stringer. IllH'96,204									Being tested at Illinois experiment stations.
Striped. SW									In Silas Wharton's collection in 1824.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Striped Angouleme. R. Syn. Striped Duchess of Angouleme									Similar to Angouleme, but striped.
Striped Bergamot. Pr74. K'41,121. D'69,865. Syn. of Swiss Bergamot									
Striped Bon Chretien. K'32,184,'41,152. Syn. Bon Chretien Panach	Fr		vl	ysg		s			Introduced by M. Vanierille, of Metz, in 1810.
Striped Dean. Pr57. K'32,140,'41,128. Syn. of Long Green (Pan.)									
Striped Dean. WPr12. D'69,881. Syn. of Striped Doyenne									
Striped Doyenne. Pr200. Syns. Doyenne Panache, Striped Dean		obop		gyr	jm			m	Quite similar to White Doyenne.
Striped Duchess of Angouleme. MassH'53,21. Syn. of Striped Angouleme									
Striped Germain. D'69,850. Syn. St. Germain Panachee, Saint Germain Striped, Striped St. Germain.	Fr	p	l	ygs	gjm	s		ml	Differs from Saint Germain in being striped.
Striped Long Green. C192. Pr57. K'32,140. B'51,307. E'54,331. Syn. of Long Green (Pan.).									
Striped Madeleine. Cole151. B'51,300. A'54,239. E'54,331. AgR'56,405. Syn. Citron des Carmes Panache.	Fr.?	t	ms	gys	mj	s	vg	e	Differs from Madeleine in being striped.
Striped Orange. Pr42. K'41,120. D'69,825. Syn. of Orange Striped									
Striped St. Germain. H192. Syn. of Striped Germain									
Stubbs. R. Syn. Stubbs Seedling	Me								Shown at Maine Pomological Meeting, 1878.
Stubbs Seedling. MeP'78,14. Syn. of Stubbs									
Stuck. HovI,5. Syn. of Glout Morceau									
Student. MassH'82,33	Mass.								One of Francis Dana's seedlings.
Stuttgart. L. Syns. Bellisime de Provence, Chevriers de Stuttgardt, Poire de Stuttgard, Rousselet de Stutgart, Rousselet Stuttgart, Stuttgarter Geishirtel.	Eur.	p	ms	gyru	cojm	sp		me	Origin near Stuttgart in 1779.
Stuttgarter Geishirtel. D'69,847. Syn. of Stuttgart									
Stuyvesant. D'69,863. A'75,103. IndH'75,42. HMHS20. CGenXXIII,398. Syn. of Bon Chretien (Sum.)									
Styer. Hort'53,31. E'54,384,'59,410. D'57,546,'69,860. H192. F275. Hof. T'75,555,'85,571,'97,715. Syn. Styre.	Pa.?	rob	ms	yeru	gbm		g-vg	me	Introduced by A. W. Corson, Montgomery County, Pa.
Styre. MagofH'54,268. Syn. of Styer									
Styrian. MagofH'37,47,'50,341. Cult'39,66. D'45,412,'57,546,'69,861. WHRN164. E'54,399,'59,424. H194. F282. L18. T'75,555,'85,571,'97,715. Syns. Keele Hall Beurre, Sugar Early.	Eng.	obop	ml	yeru	cojm	sp	g	me	
Sublime Garnotte. Cult'47,340. D'69,880. Syn. of White Doyenne									
Suchrin blanc d'Etc. D'69,804. Syn. of Blanquet (Long Stem)									
Sucre d'Automne de Tertolan. D'69,861. Syn. of Tertolan									
Sucre de Hoyerswerda. MassH'44,65. D'45,346,'57,582,'69,861. E'54,399,'59,424. F282. T'75,555,'85,571,'97,715. Syn. of Hoyerswerda.									
Sucre de Tertolan. D'69,861. Syn. of Tertolan									
Sucree blanche. D'69,804. Syn. of Blanquet (Long Stem)									
Sucree de Corinne. F282. Syn. of Corinne									
Sucree de Montlucon. GarM'72,27. Syn. of Montlucon									
Sucree de Zurich. MagofH'43,131. Syn. of Zurich									

Sucree Doree. GenF'33,197. K'41,149. D'45,401,'57,526,'69,819. F281. Syn. of Napoleon.									
Sucree Douce. F249 Syn. of Napoleon									
Sucree du Comice. MagofH'57,303. D'69,861. Syn. of Comice Sweet									
Sucre Noir d'Ete. D'69,861. Syn. of Hoyerswerda									
Sucre Verd. DomEncIV.186. Pr57. Syn. of Green Sweet									
Sucre Vert. Th187. Pr57. K'32,137,'41,127. Cult'39,66. D'57,582,'69,861. H192. F282. Syn. of Green Sweet.									
Sucre Vert d'Automne de Tolsduyn. D'69,861. Syn. of Tertolan									
Sucre Vert d'Hoyerswerda. D'69,861. Syn. of Hoyerswerda									
Suddall. R. Syn. Beurre Suddall									In the experimental orchard at Agassiz, B. C.
Sudduth. IllH'94,144,201,'95,328,'97,9,'99,27,'00,253,'05,36. Mich'94,141. A'97,44. P'95,39. CanH'96,126. AHM264.	Ill	obo	m	g	j	s	g	m	Claimed by some to be identical with Burkett.
Suet Lea. Bl229,244. GaH'97,54. IndH'79,49. Syn. Chinese Snow Pear									An oriental variety, but little grown as yet.
Suffolk. L. Syn. Suffolk Thorn	Eng	rp	s	yru	cojm		g	m	Raised from seed of Gansel Bergamot.
Suffolk Thorn. K'41,152. MagofH'42,164. Cult'48,53. MassH'53,21. D'69,862. Syn. of Suffolk.									
Sugar. Cult'39,66. IndF'40,105. HMH84	Eur								Probably introduced from Acadia in about 1680.
Sugar. Gb. FGAofO'83,223. EFABC'00. Syns. Saharnaya, Zaharna, Zucherbine.	Rus								Introduced from Rusia in 1882.
Sugar. D'45,337. E'54,396,59,422. WisHort'80,105. Syn. of Chisel									
Sugar Early. L18. Syn. of Styrian									
Sugar of Hoyerswerda. D'45,346,'57,582,'69,861. E'54,399,'59,424. Syn. of Hoyerswerda.									
Sugar Pear. MagofH'53,257. Syn. of Endicott									
Sugar Pear. Th187. Syn. of Green Sweet									
Sugar Pear. Pr145. Syn. of Harvard									
Sugar Pear. Pr9. E'54,366,'59,381. D'69,779. Bl227,230. WnI,325,II,335,III,257. L14. Syn. of Harvest.									
Sugar Pear. D'45,330,'57,450. Syn. of Joannet									
Sugar Pear of Columbia. SW. [In Silas Wharton's Catalogue, 1824]									
Sugar Pear of Hoyerswerda. A'54,239. L18. Syn. of Hoyerswerda									
Sugar Pound. Hort'75,275			l	g	co		p		Possibly the Windsor.
Sugar Top. MagofH'37,49. K'41,126. D'45,344,57,582,69,862. Cole152. E'54,399,'59,424. H192. T'75,555,'85,571,'97,715. L18. KanH'82,135. IaH'84,508. Syns. Harvest, July Pear, Lowre's Bergamotte, Lowry's Bergamot, Prince's Sugar, Prince's Sugar Top.		rt		y	jbc		p	e	Old and probably without value.
Suis d'Hiver. R. Syn. Beurre Suis d'Hiver									In Transactions American Pomological Society, 1858, p. 184.
Suisse. L. Syns. Bergamot Suisse, Bergamotto Suisse, Beurre Suisse, Swiss Bergamot.	Eur	obo	m	gyrs				m	Only desirable as a curiosity.
Suisse. K'32,140,'41,128. Syn. of Long Green (Pan.)									
Suisse. Pr74. K'41,121. Syn. of Swiss Bergamot									
Suisse Madame. F283. Syn. of Windsor									
Sukeery d'Automne. D'69,861. Syn. of Green Sweet									
Sullivan. MagofH'42,57,'47,437,'55,186. D'45,411,'57,549,'69,862. E'54,400,'59,424. H194. T'75,555. Syn. of Van Mons No 889.	Belg	oblp	m	y	jm	s	g	me	Raised by Dr. John Van Mons; named by Robert Manning.
Sultan. F282	For								Not described.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Summer. WHRIV,160. Syn. of Harvest									
Summer Archduke. K'32,132. D'69,862. Syn. of Archduke									
Summer Aremberg. T'97,715. Syn. of Aremberg (Sum.)									
Summer Beauty. AgR'93,288. JSK'97,'98. PH'97,18. IllH'98,180. NJH'99,194	Tex		l	yb	s	vg		e	
Summer Beauty. Pr26. K'32,126. Syn. of Beauty (Sum.)									
Summer Beauty. D'45,339,'57,514,'69,767. E'54,395,'59,421. F280. A'73,105. IllH'96,204. Syn. of Jargonelle (Fr.).									
Summer Bell. D'45,347,'57,585,'69,883. E'54,400,'59,425. H201. F283. A'62,90. AJofHVI,299. T'75,555,'85,571,'97,715. Syn. of Windsor.									
Summer Bergamot. GarCal587. Pr68. K'32,132. D'45,333,'57,565,'69,862. A'54,239. IllH'68,311. IaH'78,264. T'75,555,'85,571,'97,715. Syns. Bergamot Summer, Bergamotte d'Ete, Bergamotte d'Angleterre, Bergamotte d'Hampden, Beuvrier, Early Summer Bergamot, Hampden's Bergamot, Milan and Milan blanc, Milan Beuviere, Milan Blanc, Milan de la Beuvriere.	Eur	r	vs	yg	j	v	g	ve	Only valuable as a very early variety.
Summer Bergamot. K'41,120. Syn. of Franc Real (Sum.)									
Summer Bergamot. E'54,396,'59,422. H192. F277. D'57,565. Syn. of Hampden									
Summer Bergamot (Large). L. Syn. Large Summer Bergamot					brb			me	Quite distinct from Summer Bergamot.
Summer Beurre d'Aremberg. AJofHV,46. AHortA'70,77. D'69,862. Hort'70,36. A'73,76. T'75,556,'85,571. Syn. of Aremberg (Sum.).									
Summer Beurre. C182. K'32,156,'41,133. GenF'37,277. L17. Syn. of Julienne.									
Summer Bon Chretien. GarCal587. C187. Pr59. K'32,132,'41,120. GenF'37,277. Cult'39,66,'42,166. D'45,346,'57,583,'69,863. MagofH'49,440. E'54,399,'59,424. AgR'56,381. Wg74. H193. F282. T'75,556,'85,571,'97,715. Syn. of Bon Chretien (Sum.).									
Summer Butter. IndH'70,24. Syn. of Craig									
Summer Calebasse. E'54,358. Hort'55,66. Syns. Belle de Forets, Calebasse d'Ete.	Belg	oblp	m	gyru		va	p	me	Raised by Maj. Esperen.
Summer Certeau. L. Syns. Certeau d'Ete, Coloree d'Aout, Courte de Ersol, De Champagne d'Ete, Emanuel, Gros Certeau d'Ete, Rouges des Vierges.	Belg	oblp	m	ysru	jm	s	g-vg	me	By some attributed to Dr. John Van Mons.
Summer Christian. DomEncIV,190. Syn. of Bon Chretien (Sum.)									
Summer Colmar. WHRIV,164. H193. Syns. Autumn Colmar, Colmar d'Ete, Colmar Early, Colmar Precoce.	Belg	obtp	m	yeru	co	a	g-p	me	Originated in 1825.
Summer Crassane. D'69,863. Syn. of Crassane (Sum.)									
Summer Doyenne. D'45,336,'57,434,'69,742. AgR'50,94,'63,124. B'51,300. Wg69. HovI,59. E'54,321,'59,334. Cult'54,249. H194. A'62,68. T'75,256,'85,274,'97,455. WnI,325,II,335. Syns. Dean's Summer, Doyenne d'Ete, Doyenne de Juillet, Duchesse de Berri d'Ete, Duchesse de Berry d'Ete (of Bivort), Jolemont, Jolimont, Jolliemont, Jolivet, Roi Jollimont, Saint Michael d'Ete, Summer St. Michael, Summer Virgalieu.	Belg	robop	s	yrru	mj	s	g-vg	ve	Originated by Dr. John Van Mons in 1823.
Summer Doyenne (erroneously). K'32,165,'41,133. GenF'37,277. Syn. of Julienne.									
Summer Egg. MHSC'82,133									Not described.

Summer Franc Real. Pr134. K'32,185,'41,153. GenF'33,197. M'38,66,'44,52,'47,49. Cult'39,66,'54,286. MagofH'43,367. D'45,344,'57,582,'69,863. Cole154. B'51,301. Wg74. AgR'54,249. E'54,384,'59,410. H192. T'75,556,'85,571,'97,715. Syn. of Franc Real (Sum.).									
Summer Good Christian. Th192. D'45,346,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Bon Chretien (Sum.).									
Summer Jargonelle. Pr154. D'69,767. Syn. of Jargonelle (Fr.)									
Summer King. L. Syns. Great Rousselet, Gros Rousselet, King of Summer, Large Rousselet, Poire du Rousselet, Roi d'Ete, Rousselet, Rousselet le Gros, Russelet, The Rousselet.		obop	m	grru	bm	sa		me	Old and probably of little or no value.
Summer Melting. Pr. 148. MagofH'37,49. L18. Syn. Fondante d'Ete		p	m	r	j		g	me	Mr. Prince received it from Baltimore in 1802.
Summer Muscatelle. EFABC'00									In the experimental orchard at Agassiz, B. C.
Summer Pine Apple. Dap155. A'75,68. Syn. of Ananas									
Summer Pine-Apple. E'54,339. H193. D'69,660. Dap155. Syn. of Ananas d'Ete.									
Summer Portugal. Pr91. Syn. of Passans									
Summer Portugal. D'45,342,'57,532,'69,828. E'54,385. H194. F282. T'75,258,'85,276,'97,456. Syn. of Portugal.									
Summer Rose. Pr38. K'32,132,'41,119. GenF'33,197. M'38,66,'44,58. Cult'39,66. D'45,345,'57,583,'69,863. E'54,399,'59,421. F282. T'75,556,'85,571,'97,715. CGenIX,46. A'54,239. Syn. of Rose (Sum.).									
Summer St. Germain. Pr30. K'41,133. D'45,347,'57,582,'69,864. MagofH'49,106,'58,283. E'54,399,'59,424. F282. AJofHVIII,222. T'75,556,'85,571,'97,715. H194. Syn. of St. Germain (Sum.).									
Summer St. Michael. Pr137. Syn. of Bartlett									
Summer St. Michael (so called near Boston). K'32,156. GenF'37,277. Syn. of Julienne.									
Summer St. Michael. Cole151. Syn. of Summer Doyenne									
Summer Thorn. DomEncIV,186. M'38,70,'44,55,'47,59. H'41,120. D'45,346,'57,573,'69,758. E'54,399,'59,424. A'54,239. T'75,556,'85,571,'97,715. EFABC'00. L18. Syns. Bugiarda, Bugiarda des Italiens, Epine d'Ete, Epine d'Ete petite, Fondante Musquee, Green Catharine, Petite Epine d'Ete, Satin Vert, Satin Vest, Small Summer Thorn, Summer Thorn.		p	m	gy	dm	sp	g	me	
Summer Thorn of Thoulouse. Pr28. Syn. of Thoulouse									
Summer Vermilion. Pr88. Syn. of Wurtemburg(?)									
Summer Virgalieu. Cole152. B'91,364. E'54,379,'59,402. MagofH'57,26. D'69,825. Syn. of Osband.									
Summer Virgalieu. E'59,404. D'69,833. Syn. of Pinneo									
Summer Virgalieu. E'54,321,'59,354. AgR'63,124. Syn. of Summer Doyenne.									
Summer Virgalieu. D'69,864. Syn. of Virgalieu (Sum.)									
Superb. CalSBofH'92,359. A'95,68	Cal								Originated by A. Block, Santa Clara, Cal.
Superb Fondante. Cult'39,66. Syn. of Superfondante									
Superfin. FGAofO'78,49. Bul6,8. T'97,474. AHM264. Syns. Beurre Superfin, Beurre Superfine.	Fr	rp	m	yeru	jbm	vsa	vg-b	m	Originated in 1837.
Superfondante. K'41,153. MagofH'42,64. D'45,411,'57,583,'69,864. H194. F282. GenF'33,197. A'54,239. T'75,556. Syn. Superb Fondante.		obo	m	yru	bm		g	m	
Supreme. Pr26. K'32,126,'41,118. Syn. of Beauty (Sum.)									
Supreme. Pr64. Syn. of Brussels									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Supreme. SW. D'45,339,57,514. E'54,395,'59,421. F276,280. Syn. of Jargonelle (Fr.).									
Supreme. Pr10. K'32,129,'41,117. Syn. of Little Muscat									
Supreme. D'69,883. Syn. of Windsor									
Supreme Coloma. D'69,796. Syn. of Kopertscher									
Supreme Coloma Kopertsche. FGAofO'92,111. Syn. of Liegel									
Supreme d'Auray. F282. Syn. of Auray									
Supreme de Quimper. MagofH'51,299 '54,141. MassH'57,36. D'57,549,'69,864. E-59,411. A'62,70. AJofHVIII,158. CGenXI,190. T'75,253,'85,271,'97,453. MHSC-'76,26. Bul6. Syn. of Quimper.									
Supreme Quimper. F282. Syn. of Quimper									
Surpasse Crassane. D'57,549,'69,829. F282. T'75,555,'85,571,'97,715. Syn. of Passe Crassane.									
Surpasse Fortunee. D'69,766. Syn. of Fortunee									
Surpass Marie Louise (incorrectly). K'41,153. D'45,404,'57,579,'69,834. Cult'47, 340. F282. Syn. of Pitt									
Surpasse Meurice. D'57,581. F282. Syn. of Marie Parent									
Surpasse Meuris. MagofH'50,296. A'54,239. D'57,549,'69,864. F282. T'75,555, '85,572,'97,715. Syn. of Meuris.									
Surpasse St. Germain. K'32,198. M'38,93,'44,83,'47,86. L19			m		b		g	l	Introduced into England by John Braddick, esq.
Surpasse Virgalieu. M'38,77,'44,63,'47,70. D'45,416,'57,550,'69,864. Cole163. E'54, 340,'59,352. H194. F275. CGenVI,252. T'75,279,'85,297,'97,474. Syns. Beurre Van Mons, Colmar Van Mons (erroneously), Surpasse Virgouleuse, Virgalieu.	N. Y.?	robo	ml	yr	bgj	p	vg	m	Sent out by A. Parmentier, of Brooklyn, N. Y.
Surpasse Virgouleuse. D'45,415,'57,550,'69,864. MagofH'48,340. Cole163. B'51,308. E'54,340,'59,353. Syn. of Surpasse Vigalieu.									
Surprise. AgR'55,296									Not described.
Surreine. MassH'47,69									Exhibited by Robert Manning in 1847.
Susette de Bavay. WHRI,46. OH'65,41,'66,58. Syn. of Suzette									
Sutton. L. Syn. Sutton's Great Britain	N. S	obtp	l	gyrru	cojm	s		me	From seed of Bartlett. Raised by William Sutton, of Nova Scotia.
Sutton's Great Britain. FGAofO'71,26. Dap154. CanExFR'95,392,'03,421. IllH-'96,194,204. EFABC'00. Syn. of Sutton.									
Suzette. L. Syns. Susette de Bavay, Suzette de Bavay, Suzette de Bavay (Esperen), Suzette Von Bavan.	Belg	robo	s	yru	m	s	g	vl	Raised by Maj. Esperen.
Suzette de Bavay. B'51,318. Wg74. A'52,95. MagofH'53,40,104. AgR'54,243,'56,368. Hort'55,148. D'57,550,'69,865. E'54,385,'59,411. F282. T'75,290,'85,308,'97,481. EFABC'00. Syn. of Suzette.									
Suzette de Bavay (Esperen). MagofH'48,210,'49,298. E'54,385,'59,411. Syn. of Suzette.									
Suzette von Bavan. AofH'91,296. Syn. of Suzette									

Swan Egg. L. Syns. Colmar d'Ete, Egg Pear, Eyer pear, Knevett's New Swan's Egg, Little Swan's Egg, Moor Fowl Egg, Moor-fowl Egg (incorrectly), Moorfowl's Egg of Boston, New Swan's Egg, Poire d'Auch, Poire d'Œuf, Swan's Egg.		ov	s	gb	j	sp	vp	m	Very old and unworthy of cultivation.
Swan's Egg. GarCal587. C195. Pr36,150. K'32,141,'41,119,128. GenF'33,197,'37,278. Cult'39,66. SW. MagofH'50,296. A'54,239. E'54,400,'59,424. D'57,583,'69,865. T'75,556,'85,572,'97,715. Syn. of Swan Egg.									
Swan's Orange. D'45,414,'57,528,'69,823. MagofH'46,492,'49,236. Cult'48,307,'51,211. Cole165. B'51,307,'83,372. HovI,21. Wg74. AgR'50,94,'56,337. E'54,332,'59,401. WHRII 350. H195. A'62,70. T'97,715. AHM257. Syn. of Onondaga.									
Sweet August. IllH'71,183.									Not described.
Sweet Summer. D'45,337,'57,514,'69,758. E'54,373,'59,393. F280. Syn. of Jargonelle (Eng.).									
Sweetwater. WHRI,45.									Not described.
Swiss. IaH'83,101. IllH'90,126,'94,137,'96,45,204.									On trial with T. E. Goodrich, Cobden, Ill.
Swiss Bergamot. Pr74. D'45,367,'57,564,'69,865. MagofH'50,296. E'54,400,'59,424. T'75,556,'85,572,'97,715. Syns. Bergamot Royee, Bergamot Suisse, Bergamotte Suisse, Striped Bergamot, Suisse.		rt	m	gsry	mj	s	g	m	A beautiful, roundish, striped pear.
Swiss Bergamot. F277. Syn. of Suisse.									
Swithin. R. Syn. Saint Swithin.									In Benjamin Buckman's trial collection, Farmingdale, Ill.
Sykle. D'45,415,'57,443,'69,852. Syn. of Seckel.									
Sycle. HovII,33. E'54,335,'59,347. Syn. of Seckel.									
Sylvanche. Pr77. D'69,866. Syn. of Sylvange.									
Sylvanche Vert d'Hiver. D'45,360,'57,424. Syn. of Diel.									
Sylvanche Verte. M'38,90,'44,78. Cult'47,340. Syn. of Diel.									
Sylvange. Pr77. D'45,413,'57,583,'69,866. E'54,400,'59,425. H195. F283. T'75,556,'85,572'97,715. Syns. Bergamot Sylvanche, Bergamot Sylvange, Bergamotte Sylvange, Green Sylvange, Silvanbirne, Sylvanche, Sylvange Pierard, Sylvange Vert d'Hiver, Green Winter Sylvanche, Sylvange Vert, Winter Sylvanche.	Eur.	robo		g	jdm	s	g	m	Keeps remarkably well after maturity.
Sylvange d'Hiver. D'69,760. Syn. of Figue.									
Sylvange Vert. K'32,185,'41,157. GenF'37,277. Syn. of Sylvange.									
Sylvange Vert d'Hiver. Pr214. K'41,126. Syn. of Sylvange.									
Sylvange Verte. HMHS222. Syn. of Diel.									
Sylvanghe Vert d'Hiver. K'41,156. HovI,77. F277. D'69,686. Syn. of Diel.									
Sylvestre d'Automne. Dap155. Syn. of Wurtemburg.									
Sylvestre d'Hiver. Dap155. Syn. of Wurtemburg.									
Tabuniste. MichH'76,143.									Not described.
Tachete. L. Syn. Seigneur Tachete.									Not described.
Tacon. L. Syn. Beurre Tacon.									Not described.
Tacotat. R. Syn. St. Germain Tacotat.									Not described.
Taike. AofH'91,296. T'97,706,715. Syn. of Golden Russet.									
Takasaki. GarF'92,49,54.									Exhibited by P. J. Berckmans at meeting of Georgia Horticultural Society.
Talmadge. Hort'70,125. Dap154. MassH'80,236. A'81,123. Syns. Northford Seckel, Northford Seedling.	Conn.	obo	s	yru	jm	sp		me	Raised by Levi Talmadge, Northford, Conn.
Talmont. F283.	For.								Not described.
Tanne. R. Syn. Beurre Tanne.									Published by Magazine of Horticulture, 1842, p. 431.
Tardif de Mons. D'69,866. Syn. of Mons (Tardif).									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Tardive d'Anvers. WNYH'05,140									Exhibited by Ellwanger & Berry at meeting of Western New York Horticultural Society, 1905.
Tardive de Toulouse. D'69,749. Syn. of Winter Duchesse									
Tarling. K'32,142. Syn. of Easter Bergamot									
Tarling or Terling. Pr77. GenF'37,278. Syn. of Easter Bergamot									
Tarquin. Pr130. K'41,126. B'51,318. E'54,400,'59,425. Hort'64,110. Syn. of Pyrenees.									
Tarquin de Pyrenees. F283. Syn. of Pyrenees									
Tarquin des Pyrenees. D'57,550,'69,866. T'75,556,'85,572,'97,716. Syn. of Pyrenees									
Tatnall. R. Syn. Tatnall's Harvest							p		Not described.
Tatnall's Harvest. MagcH'53,424. Syn. of Tatnall									
Taunton. L. Syn. Squash, Taunton Squash, Taynton Squash	Eng				d			e	Cultivated for perry in England.
Taunton Squash. C212. Syn. of Taunton									
Tavernier. L. Syn. Tavernier de Boulogne	For								Not described.
Tavernier de Boulogne. F283. EFABC'00. Syn. of Tavernier									
Taylor. AgR'73,282. C(O)HS'87,89. Syns. Merriweather, Taylor Pear, Taylor's Virginia, Taylor's Winter.	Va	rob	m	gru	cojm	s	g	ml	Origin near Charlottesville, Va., with Mr. Merriweather.
Taylor. R. Syn. Jas. Taylor's Pear									Published in Magazine of Horticulture, 1847, p. 157.
Taylor Pear. A'52,142. F275. E'59,411. T'75,556,'85,572,'97,716. Syn. of Taylor									
Taylor's Virginia. AgR'58,422. Syn. of Taylor									
Taylor's Winter. AgR'58,421. Syn. of Taylor									
Taynton Squash. EFABC'00. Syn. of Taunton									
Tchebiche. CanH'94,2[illegible]3									Not described.
Tea. MagofH'50,154,'51,472,'52,487,'54,466. E'54,385,'59,411. D'57,551,'69,866. H-196. Hort'58,473. A'58,57. F275. AHortA'70,77. T'75,279,'85,297,'97,474.	Conn	obop		yrru	djm	v	g-vg	me	Raised by Mrs. Ezra Merchant, Milford, Conn.
Teinton. L. Syn. Teinton Squash	Eng		m	g					Grown in England for perry.
Teinton Squash. Pr210. GenF'33,197,'57,278. CGenX,239. Syn. of Teinton									
Terling. K'32,142,'41,124. D'45,429,'57,564,'69,751. E'54,389,'59,417. Syn. of Easter Bergamot.									
Terreneuraise. K'32,143. D'69,700. Syn. of Caissoy									
Tertolan. L. Syns. Sucre d'Automne de Tertolen, Sucre de Tertolan, Sucre Vert d'Automne de Tolsduyn.	Hol	rp	ms	gru	mj	sp		m	Originated in Holland; described by Verger.
Tessie. EFABC'00									In the experimental orchard at Agassiz, B. C.
Tete de Chat. D'69,716. Syn. of Catillac									
Teton de Venus. F279. Syn. of Catillac									
Teton de Venus. Pr112. K'32,142. GenF'33,197. Syn. of Du Bur									
Teton de Venus. D'69,772. Syn. of Gilogil									
Thatcher. R. Syn. Anthony Thatcher									Published in Transactions of the Indiana Horticultural Society, 1875, p. 42.

The Dean. JVL'99,'02	N. C.?		vl				vg	me	Cultivated for many years at Oak Ridge, N. C.
The Double Flower. Pr107. Syn. of Double Flower									
The Fairest or Supreme. Pr26. Syn. of Beauty (Sum.)									
Theliens. R. Syn. Paul Theliens									Published by Magazine of Horticulture, 1852, p. 474.
The Marquis. EFABC'00. Syn. of Marquise									
The My God Pear. Pr37. D'69,656. Syn. of Mon Dieu									
Theodore. E'54,385. Syn. Theodore Van Mons	Belg.	oblp	ml	gyru	cojm	v	g-vg	m	Supposed to have originated with Dr. John Van Mons in 1827.
Theodore Van Mons. MassH'53,17. AgR'54,245. Hort'54.79,'59,32. E'54,385,'59,411. D'57,551,'69,867. Cult'58,110. CGenIII,11. HEH&B'73. T'75,267,'85,285,'97,465. Syn. of Theodore.									
The Prince. L. Syns. Poire de Prince, The Prince's Pear	Fr.	r		yr				me	
The Prince's Pear. Pr35. Syn. of The Prince									
The Princess. Pr11. D'69,818. Syn. of Muscat Robert									
Therese. CanH'89,10,11. GHM&S'90. Syn. Bonne Therese	Fr.	rov	m	gyr	djm	sp		m	Originated in Malines, France.
Therese Appert. AHortA'70,75. A'71,55. Dap136. AgR'75,381. T'75,556,'85,572,'97,716. Mich'75,285. E&B'94. AHM265. Syn. of Appert.									
Therese Kumps. MagofH'53,151. D'69,868. Syn. of Kumps									
The Rose Pear. Pr38. D'69,863. Syn. of Rose (Sum.)									
The Rousselet. D'69,843. Syn. of Summer King									
The Two Sisters. D'69,736. Syn. of Sisters									
Thick Twig. CanExFR'96,136									Not described.
Thielens. R. Syns. Paul Thielen, Paul Thielens	Belg.	rob	ms	yeru	cojm	a	g	m	Raised by Dr. John Van Mons. Fruited in 1844.
Thierard. L. Syn. Lydia Thierard	Fr.	r		gbru	jm	sp		l	Raised by Jules Thierard, Bethel, France.
Thiessoise. D'69,678. Syn. of Amanlis									
Thintwig. Gb. CanExFR'96,136. Syns. Limbertwig, Smolensk, Tonkavetka Tonkovietka, Tonkowetka.	Rus.								Introduced from Russia in 1879.
Thirriot. EFABC'00. CanExFR'02,379. Syns. Fondante de Thirriott, Fondante Thirriot.		oblp	l	gy	mj	sp		m	In the experimental orchard at Agassiz, B. C.
Thompson. Cole167. NWFG'55,128. CGenXXVI,190. CanExFR'95,391. EFABC'00. Syns. Thompson's, Thompson's London, Thomson.	Eng.	obop	m	yru	bm	sp	g-vg	m	Named by Robert Thompson, of London Horticultural Society.
Thompson (N. H.). R. Syn. Thompson of N. Hampshire	N. H.?								Rejected by Congress of Fruit Growers, 1849.
Thompson of N Hampshire. MagofH'50,296. A'54,239. Syn. of Thompson (N. H.)									
Thompson's K'32,198. GenF'33,197 Cult'39,66,'48,53. MagofH'37,51,'40,50,'47,345. D'45,413,'57,552,'69,868. M'47,95. E'54,342,'59,353. F283. T'75,279,'85,297,'97,474. AofH'92,277. Syn. of Thompson.									
Thompson's London L19. Syn of Thompson									
Thomson. WHRIII,162. Syn. of Thompson									
Thooris. MagofH'60,221. D'69,868	Belg.	ov	ms	y	cod	s	p	me	Introduced in 1854; not desirable.
Thornless Ambrette. Pr122. Syn. of Ambrette (Thornless)									
Thorny Ambrette. Pr122. D'69,658. Syn. of Ambrette									
Thorny Colmar. L. Syn. Colmar Epine	Belg.	robl	l	yeru	mj	s	g	me	Originated by Dr. John Van Mons.
Thorny Rose. Pr38. K'32,132,'41,119. D'45,345,'57,583,'69,863. E'54,399,'59,424. F282. Syn. of Rose (Sum.).									
Thorp. D'57,563. MagofH'58,516. F275. E'59,411. Syn. Prindle	Vt.	obop	ml	ybr	co		g	ml	Originated at Brandon, Vt.
Thouars. L. Syns. Belle de Jersey, Belle de Thouars, Belle de Prague, Belle de Thouarse, Belle de Troyes, Coulon de Saint Marc, Poire St. Marc, Saint Marc.	Fr.?	oblp	ml	yru	d	s	p	l	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Thouin. D'69,884. Syn. of Winter Nelis									
Thoulouse. L. Syns. Epine d'Ete de Thoulouse, Summer Thorn of Thoulouse	Fr	t		g	m	sv			
Thoury. L. Syn. Beurre Thoury		rt	ml	gy	bj		g	me	Buerre Thoury of Hooper, p. 132.
Thuerlinck. D'57,553. F283. E'59,411. Syn. of Thuerlinckx									
Thuerlinckx. D'69,868. T'75,556,'85,572,'97,716. Syns. Beurre Tuerlinckx, Thuerlinck, Tuerlinckx.	Belg	oblp	vl	gb	b	ac		l	Grown at Malines; exhibited in 1848.
Thumb. L. Syns. Beurre Adam, Bishop's Thumb, Rousseline (of some)	Eng	obl	ml	ygru	jm	va	g	m	Very long and oddly shaped like a thumb.
Thury. L. Syns. Hericart de Theury, Hericart de Thury, Hericart de Thusy, Rushmore, Rushmore's Bon Chretien.	Belg	obtp	ml	yrru	j	a	g	ml	Raised by Dr. John Van Mons.
Tiflin. AgR'93,289	Ohio								Originated with Henry Loose, of Tiflin, Ohio.
Tilling. R. Syn. Tilling Frangipane									Not described.
Tilling Frangipane. MagofH'41,473. Syn. of Tilling									
Tillington. Pr208. K'32,186,'41,130. MagofH'43,132. D'57,584,'69,868. F283. T'75,556,'85,572,'97,716.	Eng	p	m	gybru	bm	vp	g	m	Exhibited by Dr. Thomas A. Knight in 1820.
Tilton. E'54,389,'59,417. H119. D'69,658. Syn. of Ambrette									
Tilton (of New Jersey). Pr124. K'32,144,'41,123. L16. Syn. of Echasserie									
Timpling. BBL									In Benjamin Buckman's collection; not described.
Tinton. R. Syn. Tinton Squash									Tinton Squash of Magazine of Horticulture, 1837, p. 60.
Tinton Squash. MagofH'37,60. Syn. of Tinton									
Toad pear Gray Good or Summer Ambrette. Pr34. Syn. of Grise-Bonne									
Tokio. GO'01									In Gilbert Onderdonk's catalogue for 1901.
Tombe de l'Amateur. F281. D'69,821. Syn. of Poiteau									
Tom Strange. BBL. Syn. of Strange									
Tongres. L. Syns. Beurre de Tongres, De Tongres, De Tongres Mass, Durandeau, Durondeau, Poire Durandeau, Poire de Tongres.	Fr	obop	b	yeru	dmj	vs	vg	m	Raised by M. Durandeau, Tongres, France.
Tonkovetka. IaH'82,83. A'83,74. CanH'94,293. EFABC'00. Syn. of Thintwig									
Tonkovietka. Gb. MHSC'82,53. CanH'83,272. FGAofO'83,219,'91,14. IaH'85, 321,'90,207. Syn. of Thintwig.									
Tonkowetka. IaH'80,61. Syn. of Thintwig									
Tonneau. Pr108. K'41,125. F283. Syns. Belle de Jersey, Chambers' Large, De Tonneau, Germain Baker, Lent St. Germain, Pickering's Warden, Pickerring, Piper, Poire de Tonneau, Tonneau de Willem, Udale's Warden, Union, Uvedale's St. Germain, Uvedale's Warden.	For	obl	vl	gb	d	a		vl	Very large and coarse; a baking variety.
Tonneau de Willem. MagofH'43,132. Syn. of Tonneau									
Tonnelet. F283	For								Not described.
Toronto. R. Syn. Toronto Belle			l	gru			vg	l	Promising in Canada where known.
Toronto Belle. FGAofO'82,82. Syn. of Toronto									

Torpes. R. Syn. De Torpes									In the experimental orchard at Agassiz, B. C.
Toscane. R. Syn. Grand duc de Toscane									Published in Magazine of Horticulture, 1855, p. 146.
126 **Totleben.** L. Syns. General Todleben, Gen. Todtleben, General Totleben, Gen. Tottleben.	Fr.?	obop	ml	gyru	cojm	svp	vg	m	Raised by M. Fontaine. Fruited in 1855.
Totten. L. Syn. Totten's Seedling	Conn	rp	s	yeru		s	p		Raised by Col. Totten, of New Haven, Conn.
Totten's Seedling. MagofH'48,109. D'57,553,'69,868. F275. E'59,411. T'75,556,'85,572,'97,716. Syn. of Totten.									
Tougard. K'41,153. Syns. Calebasse Tougard, Tougard's Flask, Tougard Pear	Belg	oblp	m	gyru	cojm	sp	g-vg	m	Raised by Dr. John Van Mons.
Tougard's Flask. CanExFR'02,380. Syn. of Tougard									
Tougard Pear. MagofH'42,164. Syn. of Tougard									
Tougaret. F280. Syn. of Flemish									
Tourasse. R. Syn. Pierre Tourasse									In the experimental orchard at Agassiz, B. C.
Tournay. R. Syn. Tournay d'Hiver									In the experimental orchard at Agassiz, B. C.
Tournay d'Hiver. EFABC'00. Syn. of Tournay									
Treasure. Pr117. D'69,659. Syn. of Amour									
Trenton. SW									In Silas Wharton's collection in 1824.
Trescott. Cole158. D'69,869	R. I.	robo	m	yeru	gmj		g	me	Origin with Niles Trescott, Cranston, R. I.
Tresor. Pr117. K'32,149,'41,124. D'69,659. Syn. of Amour									
Tresor d'Amour. Pr117. K'32,149. MassH'45,87. F283. D'69,659. Syn. of Amour.									
Tressorier. EFABC'00									In the experimental orchard at Agassiz, B. C.
Trevoux. R. Syn. Precoce de Trevoux									In the experimental orchard at Agassiz, B. C.
Treyve. L. Bul6. Syns. Madame Treyve, Souvenir de Madame Treyve	Fr.	obop	m	yru	mj	sp		me	Raised by M. Treyve, of Trevon, France.
Triguer. R. Syn. Beurre Triguer									Published by Magazine of Horticulture, 1852, p. 150.
Trimble. AgR'54,293. D'69,773. Syn. of Glout Morceau									
Triomphe de Hasselt. AgR'54,245. F278,283. E'59,363. D'69,873. Syn. of Van Marum.									
Triomphe de Jodoigne. MagofH'48,112,'49,107,'54,140,462. Hort'51,115. B'51,318. AgR'53,282,'75,380. E'54,385,'59,412. H195. D'57,553,'69,869. F283. T'75,267,'85,285,'97,465. Syn. of Jodoigne.									
Triomphe de Lorraine. EFABC'00. Syn. of Lorraine									
Triomphe de Louvain. K'41,151. D'69,869. Syn. of Louvain (Triomphe)									
Triomphe de la Pomologie. MagofH'54,236. F283. Syn. of Pomologie									
Triomphe de Pomologique. D'69,728. Syn. of Pomologie									
Triomphe de Souvain. F283. Syn. of Louvain (Triomphe)									
Triomphe de Tournay. EFABC'00									In the experimental orchard at Agassiz, B. C.
Triomphe de Vienna. CanH'88,261,'89,352,'90,300. WNYH'93,44,'96,26. IllH'96,204,209. BBL. EFABC'00. CanH'02,441. Syn. of Vienne.									
Triomphe du Nord. AgR'54,245. F278. E'59,363. D'69,873. Syn. of Van Marum									
Triumph. BBL									In Benjamin Buckman's trial list.
Triumph. SBro. CanH'02,441. EFSofO'02,14. FGAofO'04,11. Syn. of Vienne									
Trois Jours. Cult'47,540. Syn. Poire des Trois Jours			l		b		g	ml	

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Troken Martin. D'69,814. Syn. of See									
Trompe Cassaire. Pr134. Syn. of Cassaire									
Trompe Valet. Pr122. K'32,141. E'54,389,'59,417. D'69,358. Syn. of Ambrette									
Tron. R. Syn. Son de la Mare au Tron									Published in Horticultural Art Journal, 1888, p. 74.
Trousseau. L. Syns. Docteur Trosseau, Docteur Trousseau	Fr	robtp	ml	gyru	jm	va	g-vg	ml	Originated at Saint Remy, France, in 1848.
Trout Pear. DomEncIV,180. Pr130. K'32,173. MagofH'37,49. Cult'39,66. D'45, 389,'57,500,'69,765. Cole170. B'51,305. Wg. 70. E'54,368,'59,383. T'75,556,'85,572, '97,716. Syn. of Forelle.									
Trouve. Pr115. K'41,125				gy	bm	v		vl	
Trouve de Montigny. Pr48. GenF'37,277. MagofH'48,198. E'54,355,'59,366. D'57, 474,'69,701. F278. Syn. of Montigny.									
Trubschardy Dulle. MassH'46,151. Syn. of Trucherdy Dulle									
Trucherdy Dulle. A'54,239,'56,218. Syns. Trubschardy Dulle, Trubserherdy Dulle.									Rejected by Congress of Fruit Growers, 1849.
Trubserherdy Dulle. MagofH'50,296. Syn. of Trucherdy Dulle									
Truckhill. L. Syn. Truckhill Bergamot		rob	ml	yeru	meojg		g	m	
Truckhill Bergamot. MagofH'45,327. D'69,869. Syn. of Truckhill									
True Golden Beurre. Pr49. Syn. of Brown									
Tsar. CanH'94,293									Perhaps the same as Czar.
Tsarskaya. Gb. Syn. of Czar									
Tucker. R. Syn. Tucker's Bon Chretien									Tucker's Bon Chretien of Magazine of Horticulture, 1838, p. 395.
Tucker's Bon Chretien. MagofH'38,395. MassH'44,64. A'54,240. Syn. of Tucker.									
Tucker Seedling. R. Syn. Tucker's Seedling									Rejected by Congress of Fruit Growers. 1849.
Tucker's Seedling. MassH'44,61. MagofH'50,296. A'54,240. Syn. of Tucker Seedling.									
Tudor. A'67,157				ru	mj		vg	m	Said to be a seedling of Fulton, which it resembles.
Tuerlinckx. D'69,868. Syn. of Thuerlinckx									
Tuling. F277. Syn. of Easter Bergamot									
Tulipee. D'69,863. Syn. of Rose (Sum.)									
Tuliped or Fly-Pear. Pr42. K'32,152. D'69,825. Syn. of Orange Striped									
Tulip Pear. Pr42. K'41,120. Syn. of Orange Striped									
Turk. MagofH'40,390									Not described.
Turkish Bon Chretien. WPr11. MassH'44,61. Cult'47,340. Pr41. MagofH'51,34. D'69,761. Syn. of Bon Chretien (Fl.).									
Turkish Pear. Pr41. D'69,761. Syn. of Bon Chretien (Fl.)									
Turner. L. Syn. Doctor Turner	Conn	obtp	l	yrru	jm	va	g	me	
Turner's Early (of Illinois). Dap155. A'75,68. Syn. of Early Rousselet									
Twenty Fifth Anniversaire de Leopold I. D'69,869. Syn. of Anniversary									

Two Headed. Pr29. Syns. Deux tetes, Double Headed, Double Calice, Poire a deux tetes.		t		gybr	j	pa		c	A deep suture gives the fruit the appearance of being double.
Two Sisters. EFABC'00.									In the experimental orchard at Agassiz, B. C.
Tyler. MassH'43,5. MagofH'45,437,'49,43. D'57,553,'69,869. F275. E'59,412. T 75, 556,'85,572,'97,716.	Conn.	rp	ms	yru	cogjm	v	g	m	Doubtless named for President John Tyler.
Tyngsboro. GenF'41,91. Syn. of Chelmsford.									
Tynsboro. MagofH'40,18,19,'41,169. D'69,719. Syn. of Chelmsford.									
Tyrolle. D 69,790. Syn. of Jaminette.									
Tyson. MagofH'46,433. Hort'47,433,'55,62,'71,285,'73,22,'75,244. MassH'47,54. Cole-154. AgR'50,94,'54,249. B'51,302,'83,365. Wg74. HovI,33. Cult'54,386. E'54, 341,'59,351. D'57,445,'69,870. H196. F259. A'62,70. Fi52. T'75,253,'85,271,'97,453. HMHS252.	Pa.	ap	ms	yeru	djm	sp	g-vg	me	Originated in 1837. Shown at meeting of Massachusetts Horticultural Society, 1842.
Uccle. L. Syn. Marie Louise d'Uccle.	Belg.	robop	ml	ybru	jm	va	g-vg	m	Raised from seed of Marie Louise.
Udal. Hort'52,482. D'57,514,'69,767. F280. Syn. of Jargonelle (Fr.).									
Udale's Warden. K'32,151,'41,129. Syn. of Tonneau.									
Udal Seedling. R. Syn. Udal's Seedling.	Me.?								Recommended by Gen. Herrick, of Maine.
Udal's Seedling. Hort'48,415. Syn. of Udal Seedling.									
Ukraine. R. Syn. Ukraine Bergamotte.									In experimental orchard at Agassiz, B. C.
Ukraine Bergamotte. CanExFR'96,136. Syn. of Ukraine.									
Ulm. EFABC'00.									In experimental orchard at Agassiz, B. C.
Ulmer. R. Syn. Beurre Ulmer.									In experimental orchard at Agassiz, B. C
Union. E'54,334,'59,346. D'69,835. Syn. of Pound.									
Union. Pr130. K'32,151,'41,129. GenF'33,197. Syn. of Tonneau.									
Unknown Chenau. Pr65. Syn. of Brest.									
Unknown La Fare. Pr95. Syn. of Saint Germain.									
Upper Crust. Hort'49,276. E54,385,'59,412. D'57,553,'69,870. H198. F275. A'67, 190,'73,118. T'75,556,'85,572,'97,716.	S. C.	r	ms	gru	g		p	me	Originated in South Carolina; introduced by Col. Sumner.
Urbaniste. Pr206. K'32,185,'41,154. M'38,85,'44,54,'47,63. GenF'33,197. Cult'39,66. IndF'40,187. MagofH'44,131. D'45,417,'57,445,'69,871. Cole166. B'51,308,'83,374. Wg74. HovI,21. E'54,342,'59,352. H198. F222. T'75,267,'85,285,'97,465. Syns. Beurre Drapiez, Beurre du Roi, Beurre Picquery, Beurre Piquery, Coloma d'Automne, Count Coloma, Henkel d'Hiver, Louis Dupont, Louise d'Orleans, Louise of Orleans, Picquery, St. Marc, St. Mark, St. Meare, Urbaniste Seedling.	Fl.	obop	ml	yru	bmj	p	vg-b	ml	Originated by Count Coloma, of Malines.
Urbaniste Seedling. F283. D'69,871. Syn. of Urbaniste.									
Ursula. D'69,872. Syn. Ursule.		oblp	ms	yeru	bmj	s	g-vg	m	
Ursule. Hort'61,219. Syn. of Ursula.									
Uvedale's St. Germain. Cole174. B'51,311,'83,377. Wg73. E'54,334,'59,346. D'57 537,'69,835. H198. F283. AgR'58,423. Syn. of Pound.									
Uvedale's St. Germain. Pr130. K'32,151,'41,129. GenF'33,197. D'45,448. Syn. of Tonneau.									
Uvedale's Warden. E'54,334,'59,346. Syn. of Pound.									
Uvedale's Warden. GenF33,197. D'45,448. Syn. of Tonneau.									
Uwchlan. Hort'56,55. MagofH'57,102. D'57,554,'69,872. E'59,412. F275. T'75, 257,'85,275. Syns. Dowlin, Round Top.	Pa.	robo	ms	yru	mj	vp	g-vg	me	Originated with Mrs. Dowlin, Uwchland, Pa.
Vaast. L. Syns. Beurre Beaumont, Bezi Saint Vaast.	For.								Published by Field, p. 278; not described.
Vacat. MagofH'43,38. MassH'48,99.									Exhibited by Robert Manning in 1848.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Va Deux Ans. D'69,725. Syn. of Invalides									
Vaet. L. T'97,716. Syns. Besi De St. Waast, Besi Va, Besi Vaat, Besi Vath, Besi Waet, Beurre de Beaumont, Beurre Vaet, Bezy de Saint Vaast, Bezi Vaet, Bezy Vaet, Bezy Waat, De Saint Waast.		obo	m	gyru	mj	sp	g	l	
Vaillant. L. Syns. Marechal Vaillant Marshall Vaillant, Valliant	Fr	obtp	l	gyru	m	sv	vg	ml	Originated by M. Boisbunel, of Rouen, France.
Vaisse. R. Syn. Senateur Vaisse									In the trial orchard at Agassiz, B. C.
Valandree. D'69,734. Syn. of Louvain									
Valencia. GenF'33,196. D'45,378,'57 436,'69,880. F224. AgR'62,183. Syn. of White Doyenne.									
Valentia or Valencia. Pr43. F279. Syn. of White Doyenne									
Valentine. D'69,872	N. Y	oblp	ml	ygr	jm	s	g	me	Originated on Long Island.
Valette. F283	For								Not described.
Valflore. R. Syn. Valflore de Fontenelle									In the experimental orchard at Agassiz, B. C.
Valflore de Fontenelle. EFABC'00. Syn. of Valflore									
Vallee. L. Syns. Bonne de Keinzheim, De Vallee, De Keinzheim, Vallee Franche.		obop	m	yg	j	s	p	me	
Vallee Franche. Pr83. GenF'33,197. MagofH'37,51,'41,387. M'38,70,'44,55. Cult '39,66. K'41,134. D'45,347,'57,584,'69,872. AgR'54,263. E'54,400,'59,425. H198. F'283. T'75,556,'85,572,'97,716. Syn. of Vallee.									
Valliant. CalB147,72. Syn. of Vaillant									
Van Assche. MagofH'53,174. Hort'53,60. E'54,345,'59,353. AgR'56,405. .D'57, 554,'69,872. H198. F283. Syns. Van Asshe, Vanasse, Van Assene.	Belg	obop	ml	wyeru	jm	s	g-vg	me	Variable in quality; sometimes fine.
Vanasse. E'54,345,'59,353. Syn. of Van Assche									
Van Assene. MagofH'42,38,'47,60. WHRIV,163. AgR'54,263. E'54,345,'59,353. D'57,554,'69,872. H198. Syn. of Van Assche.									
Van Asshe. E'54,345,'59,353. D'57,554,'69,872. Syn. of Van Assche									
Van Berkelaire. R. Syn. Eugene Van Berkelaire									Published in Magazine of Horticulture, 1857, p. 260.
Van Buren. MassH'43,5. MagofH'45,437,'49,43. D'45,420,'57,554,'69,873. E'54, 400,'59,425. H198. F275. T'75,556,'85,572,'97,716.	Conn	robl	m	yrru	co	s		m	Raised by Governor Edwards, of New Haven, Conn.
Van Cott. NYC'90									Mr. Lyon received Van Cott in 1894.
Van De Putte. L. Syn. Beurre Van de Putte	For								Published by Field, p. 278.
Vanderpool. OH'71,48. Hort'72,102			m				g	me	
Vanderveer. Pr156			m	yru	mb			me	
Vanderwecken. L. Syn. Rousselet Vanderwecken	Belg	rp	s	y	dmj	sp	b	ml	Raised by M. Gregoire, of Jodoigne, Belgium.
Van Deventer. D'69,873	N. J	oblp	s	gybr	jdm	s	g	me	
Vandeweyer. L. Syns. Vandeweyer Bates, Van de Weyer Bates		robo	ms	yb	bj	sp	vg	vl	Described by Hogg in the Fruit Manual.
Vandeweyer Bates. D'69,873. Syn. of Vandeweyer									

Van de Weyer Bates. MagofH'52,419. Hort'53,66. D'69,873. Syn. of Vandeweyer.									
Van Donckelaer. D'69,813. Syn. of Marie Louise.									
Van Donkelear. D'69,813. Syn. of Marie Louise.									
Vandyck. D'69,858. Syn. of Spanish.									
Van Dyck. D'69,858. Syn. of Spanish.									
126 **Van Geert.** L. Syn. Beurre Jean Van Geert	Belg	oblp	l	yr	gmj	sp		m	Originated by M. Jean Van Geert in 1864.
Van Gobbelschroy. MagofH'55,146. Syn. of Gobbelschroy.									
Van Houghten. L. Syns. Charles Van Hooghten, Charles Van Hoogten, Charles Van Houghten, Charles Van Houten.		obop	l	yru	co	s	g	m	
Van Hultem. MagofH'55,146. Syn. of Hultem.									
Van Marum. MagofH'54,460. D'57,554,'69,873. T'75,557,'85,572,'97,716. Syns. Beurre Van Marum, Bouteille, Calebasse Carafon, Calebasse de Holland, Calebasse de Nerckman's, Calebasse du Nord, Calebasse Grosse, Calebasse Imperiale, Calebasse Monstre, Calebasse Monstreuse du Nord, Calebasse Monstrueuse, Calebasse Royale, Carafon, Grosse Calabash, Grosse Calebasse du Nord, Grosse Calebasse of Langlier, Grosse Calebasse of Noisette, Grosse Van Marum, Monstreuse du Nord, Monstrous Calabash, Poire Carafour, Poire Van Marum, Triomphe de Hasselt, Triomphe du Nord.	Belg	oblp	l-vl	yr	mj	sp	g	m	Originated by Dr. John Van Mons.
Van Mons. Hort'54,83. CanExFR'98,100. EFABC'00.		obop	ml	gy	jm	p	vg	m	Col. M. P. Wilder considered it promising.
Van Mons. F279. Syn. of Invalides.									
Van Mons Elizabeth. Cult'53,313. CGenII,122.			s				vg		Dr. Wendell sent the Cultivator samples in 1853.
Van Mons Leon le Clerc. K'41,166. MassH'44,57. D'45,419,'57,584,'69,873. M'47, 91. B'51,308. HovI,9. Wg74. AgR'53,282. E'54,343,'59,413. WHRII,474. H199. A'62,70. T'75,268,'85,286,'97,465. Syn. of Le Clerc (Van Mons).									
Van Mons No. 51. MagofH'55,188. Syn. of Caen.									
Van Mons No. 108. MagofH'43,389. [Perhaps never disseminated.]									
Van Mons No. 135. MagofH'46,147. MassH'48,99. D'57,558. Syn. of Walker.									
Van Mons No. 154. D'45,385,'57,496,'69,810. E'54,366,'59,342. Syn. of Elizabeth.									
Van Mons No. 158. MagofH'42,57,'47,63. HovII,41. Syn. of Elizabeth.									
Van Mons No. 177. MagofH'43,389,'45,368. MassH'48,99. [Perhaps never disseminated.									
Van Mons No. 182. MagofH'45,368. MassH'48,99. [Perhaps never disseminated.].									
Van Mons No. 365. MagofH'43,389. MassH'48,99. [Perhaps never disseminated.].									
Van Mons No. 432. MagofH'43,389. [Perhaps never disseminated.]									
Van Mons No. 698. MagofH'43,389. MassH'48,99. [Perhaps never disseminated.]									
Van Mons No. 858. MassH'48,99. [Perhaps never disseminated.]									
Van Mons No. 879. MassH'48,99. [Perhaps never disseminated.]									
Van Mons No. 889. MagofH'42,57. D'45,411,'57,549,'69,862. Syn. of Sullivan.									
Van Mons No. 968. MassH'48,99. [Perhaps never disseminated.]									
Van Mons No. 969. MagofH'43,389. MassH'48,99. [Perhaps never disseminated.].									
Van Mons No. 982. MassH'48,99. [Perhaps never disseminated]									
Van Mons No. 1028. MassH'48,99. [Perhaps never disseminated]									
Van Mons No. 1036. MassH'48,99. [Perhaps never disseminated]									
Van Mons No. 1054. MagofH'42,58. [Perhaps never disseminated].									
Van Mons No. 1074. MassH'48,99. [Perhaps never disseminated]									
Van Mons No. 1082. MassH'48,99. [Perhaps never disseminated]									
Van Mons No. 1103. MagofH'43,389. [Perhaps never disseminated].									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Van Mons No. 1218. MagofH'42,60. D'45,372,'57,570. E'54,393,'59,420. Syn. of Commodore.									
Van Mons No. 1238. MagofH'42,60. D'45,376,'57,569,'69,722. E'54,392,'59,419. Syn. of Clinton.									
Van Mons No. 1253. MassH'48,99. [Perhaps not disseminated]									
Van Mons No. 1258. MassH'48,99. [Perhaps not disseminated]									
Van Mons No. 1295. MagofH'43,388. MassH'51,175. [Perhaps not disseminated].									
Van Mons No. 1325. MassH'48,99,'51,175. [Perhaps not disseminated]									
Van Mons No. 1451. MassH'48,99. [Perhaps not disseminated]									
Van Mons No. 1454. MassH'48,99. [Perhaps not disseminated].									
Van Mons No. 1482. MagofH'46,147. MassH'48,99. [Perhaps not disseminated].									
Van Mons No. 1535. MassH'48,99. [Perhaps not disseminated].									
Van Mons No. 1586. MagofH'43,388. [Perhaps not disseminated].									
Van Mons No. 1590. MagofH'43,388. [Perhaps not disseminated].									
Van Mons No. 1602. MassH'48,99. [Perhaps not disseminated].									
Van Mons No. 1825. MassH'53,18. [Perhaps not disseminated].									
Van Mons St. Germain. D'69,874. Syn. of New St. Germain.									
Van Mon's Seedling. GaH'86,35,50.									Exhibited by P. J. Berckmans; said to be promising.
Vannes de St. Haye. MagofH'55,146. Syn. of St. Haye.									
Vanstalle. L. Syn. La Vanstalle.		p	m	r				m	
Vanquelin. MagofH'48,112. F283. D'69,874. T'85,572. CanExFR'03,422. Syns. Poire Vanquelin, Saint German Vauquelin.	Fr.	oblp	m	gbru	jm	va	g	l	Originated at Rouen, France.
Vantais. R. Syns. Enfant Nantais, Enfant Vantais.		obop	m	yrub	j	v	g	m	In the experimental orchard at Agassiz, B, C.
Van Vranken. D'69,849. Syn. of Sacandaga.									
Variegated Crasanne. Pr76. Syn. of Crassane Panache.									
Varenne. R. Syn. Directeur Varenne.									In the experimental orchard at Agassiz, B. C.
Varuna. MassH'66,44.	Mass.								Originated at Brookline, Mass., by Dr. S. A. Shurtleff.
Vasschanka. CanH'94,291. Syn. Poire Cire.	Rus.?		m	y			vg	me	Ripens in August, but will keep till October.
Vauquelin. MagofH'48,112. D'57,554,'69,874. F283. T'75,557,'85,572,'97,716. EF-ABC'00. CanExFR'03,422, Syns. Poire Sentin, Poire Vauquelin, Saint Germain Vauquelin.	Fr.	oblp	m	gbru	jm	va	g	l	Received from Rouen, France.
Vaux. L. Syns. Cadet de Vaux, Cadette de Vaux.		obtp	l	ybr	dmj	sp	g	vl	
Vemulen d'Ete. F242. Syn. of Wurtemburg.									
Venerable. R. Syn. Souvenir du Venerable de la Salle.									In the experimental orchard at Agassiz, B. C.
Verdasse. GenF'37,277. Syn. of Cassolette.									
Verdette. D'69,861. Syn. of Green Sweet.									

Vergalu. Pr43. Cult'39,66. Syn. of White Doyenne									
Verlaine. D'69,874. Syn. Verlaine d'Ete	Belg.	oblp	m	ybr	mj	sv		me	Originated with Dr. John Van Mons.
Verlaine. K'41,145. D'69,770. L17. Syn. of Gendesheim									
Verlaine d'Ete. K'41,145. D'69,770. Syn. of Gendesheim									
Verlaine d'Ete. D'69,874. Syn. of Verlaine									
Vermilion. Pr64. K'32,141,'41,162. D'69,668. Syn. of Brussels									
Vermilion d'Ete. D'45,339,'57,514,'69,767. E'54,395,'59,421. F280. Syn. of Jargonelle (Fr.).									
Vermillion d'Automne. D'69,668. Syn. of Brussels									
Vermillion d'en Haut. D'69,874. T'75,557,'85,572,'97,716. Syn. of Vermillion (Haut).									
Vermillion d'Espagne d'Hiver. D'69,858. Syn. of Spanish									
Vermillion d'Ete. Pr58. D'57,574,'69,767. Syn. of Wurtemburg									
Vermillion d'Hiver des Dames. D'69,669. Syn. of Du Bur									
Vermillion des Dames. D'69,668. AJofHVIII,223. Syn. of Brussels									
Vermillion E tranguillon. FGAofO'92,108. Syn. of Long									
Vermillion (Haut). L. Syn. Vermillion d'en Haut	Eur.	obop	m	gyr	dmj	s		me	
Vermont. D'69,874. AgR'91,390. Syn. Vermont Seedling	Vt.	obtp	ms	wyru	jm	s	g-vg	m	Taken from Vermont to Oswego, N. Y., where it fruited.
Vermont Beauty. WNYH'89,65,'90,176,'91,134. HAJ'89,70. AofH'89,151. IllH'92, 173,'96,178. CanH'93,184. AndN'95. NJH'93,78,'02,217. T'97,474. IEI'99,'01,'02. E&B'02. Bul8. AHM267.	Vt.								Origin on Grand Isle, Lake Champlain, Vermont.
Vermont Seedling. D'69,874. WisH'75,69. Syn. of Vermont									
Vernon. FGAofO'93,146									Not described.
Verte de Livoine. R. Syn. Beurre Verte de Livoine									Not described.
Verte Longue. C193. Pr56. K'32,138,'41,120. D'45,418,'57,556,'69,803. Cole159. B'51,307. E'51,331,'59,341. AgR'54,251. H199. T'57,557,'85,572,'97,716. Syn. of Long Green.									
Verte Longue d'Anger. D'57,555,'69,760. F283. T'85,286,'97,465. Syn. of Figue									
Verte Longue d'Automne. Pr56. Syn. of Long Green									
Verte Longue d'Automne. MagofH'49,448. D'69,804. T'85,282. Syn. of Long Green (Aut.).									
Verte Longue d'Hiver. Pr124. D'69,753. Syn. of Echasserie									
Verte Longue de la Mayenne. D'57,498,'69,760. F280. E'59,382. Syn. of Figue									
Verte Longue de la Mayenne. E'59,341. Syn. of Long Green									
Verte Longue of Esperin. D'69,804. Syn. of Long Green (Esp.)									
Verte Longue Panache. C192. K'32,140,'41,128. A'54,240. E'54,331. B'51,307. F283. D'69,804. Syn. of Long Green (Pan.).									
Verte Longue Panachee or Suisse. Pr56. EFABC'00. Syn. of Long Green (Pan.)									
Verte Longue Striped or Suisse. Pr57. K'32,140. Syn. of Long Green (Pan.)									
Verte Longue Suisse. F283. Syn. of Long Green (Pan.)									
Verulam. MagofH'56,84. Hort'58,321. D'69,875. EFABC'00. Syns. Black Beurre, Buchanan's New Spring Beurre, Buchanan's Spring Beurre, New Spring Beurre, Spring Beurre.		obo	l	gbru	co			vl	From the Fruit Manual; old and of little value.
Vesouziere. MagofH'52,165. E'54,386. Syn. of Vezouziere									
Vessouziere. MagofH'51,472,'52,150. MassH'51,189. Syn. of Vezouziere									
Veterans. L. T'97,716. Syns. Bonveau, Bezi des Veterans, Bezi de Veterans, Bezi Veterans, Des Veterans, Poire Rameau, Rameau.	Belg.	obtp	l	yru				l	
Vezouziere. D'57,556,'69,875. A'56,88. F283. E'59,412. FGAofO'72,12. T'75,557, '88,572,'97,716. CanH'85,32. Syns. Vesouziere, Vessouziere.	Fr.	rob	ms	y	jm	s	g-vg	me	Raised by M. Leon le Clerc.
Vicaire de Winkfield. D'69,875. Syn. of Vicar									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Vicar. HHH'67,139. Bul6,8. FESofO'01,22. AHM267. Syns. Belle Adrienne, Belle Arthrearie, Belle de Berry, Belle Epine Dumas, Belle Heleres, Belle Heloise, Belle Heloise Clion, Bon Papa, Bourgermester, Bourgermuester, Burgomaster, Clion, Comice de Toulon, Cueillette d'Hiver, Cure, Curette, De Clion, De Monsieur Le Cure, Duc de Bordeaux, Du Cure, Dumas, Du Pradel, Epine Dumas, Grosse Allongee, Lonffroy, Le Cure, Messire d'Hiver, Missire d'Hiver, Monsieur, Monsieur le Cure, Pater Notte, Poire Monsieur le Cure, Pradello de Catalogue, Vicaire de Winkfield, Vicar of Wakefield, Vicar of Winkfield, Winkfield.	Fr	oblp	l	yb	jb	a	g	ml	Was discovered in the forests of Clion, France.
Vicar Junior. MassH'72,92. Hort'75,1	Mass.								From seed of Vicar; originated by Col. M. P. Wilder.
Vicar of Wakefield. [illegible] HHH'67,139. F153. Syn. of Vicar									
Vicar of Winkfield. [illegible] MagoffH'45,120,269. D'55,458,'57,557,'69,875. Cole[illegible] [illegible] W[illegible] HovI,47. E'54,344,'59,454. G85. T'75,290,'85,508,'97,481. WmI,327,II,337,III,259. Bul8. Syn. of Vicar.									
Vice President Decaye. EFABC'00. Syn. of Decaye									
Vice President Delahaye. EFABC'00. CanExFR'05,430. Syn. of Delahaye									
Vicker. MoHS'86,[illegible]. AgR'92,262. Syn. of Victor									
Vicompte de Spielberg. F283. Syn. of Spoelberch									
Vicomte de Spoelberch. K'32,199,'41,166. MagoffH'46,293. HovI,13. E'54,385,'59,412. D'57,558,'69,877. T'75,293,'85,311,'97,484. Syn. of Spoelberch.									
Vicomte de Spielberg. MagoffH'45,270. B'51,319. HovI,13. AgR'54,251. E'54,385,'59,412. Syn. of Spoelberch.									
Victor. SBro'81. AgR'92,262. A'95,73. BBL. CanExFR'95,392. HHH'96,178,194. Syns. Miller's Victor, Vicker.	Pa								Taken to Missouri by Samuel Miller; introduced by Stark Bros.
Victor Hugo. EFABC'00. Syn. of Hugo									
Victoria. MagoffH'58,276,156. CanExFR'96,156	Eng							l	Raised by Rev. John Huyshe.
Victoria. D'69,773. Syn. of Glout Morceau									
Victorina. Gb. NebS'90,130. IaB3. HHH'92,172. IaH'94,170. MichB104. EFABC'00. Syn. Victorina Mnogoplodnaya.	Rus.	t		yg	cog	v	p		Introduced from Russia in 1879.
Victorina Mnogoplodnaya. Gb. Syn. of Victorina									
Vidovka. EFABC'00									In the experimental orchard at Agassiz, B. C.
Vienne. R. Syns. Triomphe de Vienne, Triumph	Fr			gy	bj	s	vg	me	Fruited at Hamilton, Ontario, in 1887.
Vierry. R. Syn. Schaching Vierry									Shown by Robert Manning in 1846.
Vigne. Pr58. K'41,122. MagoffH'43,132. Syns. Demoiselle, Poire de Vigne, Vine or Lady's, Vine Pear, Vigne Demoiselle, Vine or Damsel.		t		m	m			m	
Vigneau. R. Syn. Secretary Alfred Vigneau									In the experimental orchard at Agassiz, B. C.
Vigne Demoiselle. Pr58. Syn. of Vigne									
Vignes. D'69,733. Syn. of Hardenpont (Aug.)									
Vigneuse d'Esperen. F283. Syn. of Vineuse									

Viliane d'Anjou. D'69,863. Syn. of Rose (Sum.)								
Villaine d'Anjou. K'41,120. Syn. of Orange Striped								
Vilmorin. L. Syn. Louis Vilmorin	Fr	obtp	m	yru	jm	sp	g-vg	l	Originated with Andre Leroy, Angers, France.
Vincennes. MagofH'42,403. WHR'51,281. AJofH'67,361. IndH'75,42. KanH'80, 18'82,137. CGenXVII,288 IaH'84,510. Syn. of Ockletree.								
Vincent. L. Syn. Saint Vincent de Paul	Eur	obp	m	yru	jm		g	ml	
Vindre. L. Syn. Besi de Vindre	For								Published by Field, p. 278.
Vine or Damsel. Pr58. Syn. of Vigne								
Vine or Lady's. Pr58. Syn. of Vigne								
Vine Pear. Pr58. Syn. of Vigne								
Vineuse. D'69,877. ÀHortA'71,70. Syns. Vigneuse d'Esperen, Vineuse d'Esperen.	Belg	obtp	ml	gbru	cojm	ac	g	m	Raised by Maj. Esperen; introduced in 1840.
Vineuse d'Esperen. MagofH'54,236. D'69,877. AHortA'71,70. Syn. of Vineuse.								
Vingt Mars. F283	For								Not described.
Vinograd. Gb. Syn. Vinogradnui	Rus								Introduced from Russia in 1882.
Vinogradnui. Gb. IaH'85,323. CanExFR'96,136. Syn. of Vinograd								
Virgalieu. Hort'58,473. Syn. of Pinneo								
Virgalieu. B'51,308. Syn. of Surpasse Virgalieu								
Virgalieu. WPr9. IndF'40,182. Cult'42,166. E'54,332,'59,336. A'62,68. AgR'62,183. MichH'73,343. T'75,557,'85,572,'97,716. B'83,369. WnI,326,II,336,III,259. Syn. of White Doyenne.								
Virgalieu (erroneously of some). E'54,369,'59,384. Syn. of Bremer								
Virgalieu No. 4. WNYH'05,141. [Exhibited by Ellwanger & Barry]								
Virgalieu of New York. GenF'33,196. Cult'44,36. D'45,378,'57,436,'69,880. AgR-'50,95. HovII,85. Cole165. Syn. of White Doyenne.								
Virgalieu (Sum.). L. Syns. Powell's Virgalieu, Summer Virgalieu		rp	m	yru	jm	v	g	me	Origin not certainly known.
Virgaloo. D'45,378,'57,436,'69,880. E'54,322,'59,336. Syn. of White Doyenne								
Virgin of Xaintonge (erroneously). Tr89. Syn. of Chat Brusle								
Virgin of Xaintonge. Pr11. D'69,818. Syn. of Muscat Roberts								
Virgoulee. Pr87. Syn. of Virgouleuse								
Virgoulese. Pr87. Cult'39,66. D'69,877. Syn. of Virgouleuse								
Virgouleuse. DomEncIV,179. GarCal587. C196. Th192. WPr9. K'32,149,'41,124. Pr87. GenF'33,197. D'45,450,'57,584,'69,879. E'54,400,'59,425. AofH'91,296. EFABC'00. Syns. Bujaleuf, Chambrette, Chambrette d'Hiver, Ice Pear, La-Virguleuse, Le Virgoule, Poire de Glace, Poire de Glace (of Gascony), Poire-Glace, Virgalouse, Virgolese, Virgoulee, Winter Virgalieu (erroneously).	Fr	p	m	yg	b		g	l	
Viscount de Spaeberg. FGAofO'71,21.									Not described.
Vital. AofH'91,296. Syn. Beurre Vital									In the experimental orchard at Agassiz, B. C.
Vitrier. Pr106. K'41,123. Syn. Poire du Vitrier		ov	l	grb		v	g	l	Described by Duhamel.
Vitry. R. Syn. Belle de Vitry									Published by Kenrick as new and fine.
Vizouriere. Hort'51,307									Sent the Horticulturist by A. Fahnestock, of Ohio.
Voix aux Pretres. MassH'45,87									Shown by Col. M. P. Wilder at meeting of Massachusetts Horticultural Society.
Volga. MassH'93,297. Syn. Wild Pear.	Rus.?								Not described.
Volga Bergamotte. FGAofO'92,97	Rus.?						p		Not described.
Von Mouchn. R. Syn. Herzogin Von Mouchn									Published in Annals of Horticulture, 1891, p. 296.
Von Siebold. IndH'79,49. MichH'80,84. Syn. of Siebold								

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Von Zugler. D'69,877. Syn. of Zugler									
Voronege. R. Syn. Bergamotte de Voronege									Published by Canadian Horticulturist, 1894, p. 291.
Voronesh No. 18. CanExFR'96,136. EFABC'00. [Not named and disseminated.]									
Veronesh No. 28 CanExFR'96,136. EFABC'00. [Not named and disseminated.]									
Veronesh No. 102. CanExFR'96,136. EFABC'00. [Not named and disseminated.]									
Voscovaya. Gb. CanExFR'96,136. Syn. of Waxen									
Voskovaya. Gb. IaH'85,323. Syn. of Waxey									
Vsduti. L. Syn. Bergamot Vsduti	Rus.?								Introduced from Russia in 1882.
Wadleigh. Cole154. MagofH'54,81. D'57,558,'69,877. F275. T'75,557,'85,573,'97,716. A'79,93.	N. H.	r	m	yru	dgjm	sp	g	me	
Wael. R. Syn. De Wael									Published in Magazine of Horticulture, 1853, p. 525.
Wagelwater. L. Syn. Premices de Wagelwater		robop	ms	yru	jm	s	g-vg	m	
Wales. R. Syn. Prince of Wales									Published in Annals of Horticulture, 1890, p. 202.
Walker. MagofH'49,193,'58,533. AgR'54,245. A'54,162. E'54,386,'59,412. D'57,558, '69,877. F283. CGenX1,174. T'75,557,'85,573,'97,717. Syns. Amande regenerie, No. 135 Van Mons.	Belg.	oblp	l	gyeru	cojm	va	v-vg	m	Raised by Dr. John Van Mons.
Walker's Seedling. MassH'60,50. D'69,818. T'75,557,'85,573,'97,717. Syn. of Mount Vernon.									
Walnut. WHRI,64									Shown at meeting of Cincinnati Horticultural Society, 1850, by J. R. Jackson.
Ward. MagofH'36,79. Syn. Ward's Bell Pear									Cultivated by Silas Wharton in 1824.
Ward's Bell Pear. SW. Syn. of Ward									
Warden. K'32,151,'41,129. MagofH'43,132. Syn. Brown Warden		t	m	yru				m	
Warden. A'75,102,'79,81. IndH'75,42. HMHS15,16. Syn. of Pickering									
Warmsley. R. Syn. Warmsley Grange									Not described.
Warmsley Grange. Cult'39,66. Syn. of Warmsley									
Warner. NebH'90,129. IaH'94,169,'96,161,'99,86. BBL. WisH'03,172. Syn. Warner's Seedling.	Ind.		m				g	m	Origin with Dr. Boor, of Henry County, Ind., in 1832.
Warner's Seedling. IndH'79,170,85,123. IllH'92,172. NJH'93,78. Syn. of Warner									
Warsaw. L. Syns. Bergamotte ordainaire (of Warsaw), Warsaw Bergamot	Rus.								Introduced from Russia in 1882.
Warsaw Bergamot. Gb. Syn. of Warsaw									
Warwick Bergamot. GenF'33,196. D'45,378,'57,436,'69,880. E'54,322,'59,336. F224. Agr'62,183. Syn. of White Doyenne.									
Washington. K'32,187,'41,134. M'38,80,'44,67,'47,71. MagofH'43,384,'44,296,'48,84. D'45,422,'57,559,'69,878. Hort'47,174,'74,142,283. Cole157. AgR'50,94. B'51,309, '83,374. E'54,345,'59,356. H200. F271. Wg75. T'75,280,'85,298,'97,474. Bl238. AHM267. Bul6,8. Syns. Naaman's Creek, Namen's Creek, Robertson, Robinson.	Del.	ov	m	y	jm	s	vg	me	Discovered in a hedge near Naaman's Creek, Delaware.
Waterloo. Cult'47,340. MagofH'53,107. D'57,494,'69,747. F260. T'75,557,'85,573, 97,'717. IllH'89,346. Syn. of Brabant.									

Watermelon. Hort'53,458. D'57,508,'69,784. Syn. of Hosencheck									
Watermelon (of some). D'69,883. Syn. of Windsor									
Water (of some). D'69,883. Syn. of Windsor									
Watertown. Cole163. HovII,35. E'54,360,'59,372. D'57,482,'69,722. Syn. of Collins									
Watson. MagofH'44,212. D'69,878	Amer.	robo	ms	yru	coj	s		me	
Waxen. Gb. MinnH'90,293. Syn. Voscovaya	Rus.								Professor Budd thought this and Waxey identical.
Waxey. Gb. IaH'85,323. Syns. Voskovoi, Voskovoya	Rus.		l	y			g		
Wayne. E'54,347. Hort'56,184. D'57,444,'69,855. Hof. Syn. of Sheldon									
Weaver. MoH'96,38									Reported by Judge Miller to Missouri Horticultural Society.
Webber. R. Syns. Webber's Autumnal, Webber's Yellow Autumnal				y				m	Not described.
Webber's Autumnal. Cult'47,540. Syn. of Webber									
Webber's Yellow Autumnal. MagofH'38,395. Syn. of Webber									
Webster. D'69,878	N. Y.	robtp	m	yeru	jm	sp	g-vg	m	Originated at Hudson, N. Y.
Weeping Willow. MassH'67,37. AJofHIII,187	Mass.						p		Origin with A. Foote; tree of drooping habit.
Weidman. R. Syn. Weidman's Early									Not described.
Weidman's Early. FGAofO'72,106. Syn. of Weidman									
Weiler. R. Syn. Weiler'sche Mostbirn									Not described.
Weiler'sche Mostbirn. MHSC'85,28. Syn. of Weiler									
Weimar. R. Syn. Duc de Saxe Weimar									Published in Magazine of Horticulture, 1855, p. 146.
Weinbirne Grune. Gb. Syn. of Green Wine									
Weisse Herbst Butterbirne. D'45 378,'57,436,'69,880. Syn. of White Doyenne									
Weist. MagofH'54,269					j		g	m	Not described.
Welbeck. GenF'33,197. Syns. Hepworth, Welbeck Bergamot, Welbeck Seedling.		r	ml	yeru	cojm	s	p	m	From Hogg's Fruit Manual.
Welbeck Bergamot. MassH'45,89. D'69,879. Syn. of Welbeck									
Welbeck Seedling. GenF'33,197. Syn. of Welbeck									
Wellington. MagofH'53,107. A'54,240,'67,157. D'69,879	Mass.	oblp	l	yg	cojm	sp		v	First shown at meeting of Massachusetts Horticultural Society, 1864.
Weltz. A'71,52. AgR'75,380									Introduced by Leo Weltz, of Wilmington, Ohio.
Wendell. MagofH'50,460. WHRIV,204. D'57,558,'69,879. H200. F283. E'59, 414. T'75,557,'85,573,'97,717.	Belg.	rp	s	yeru	gjm	s	g	me	Raised by Dr. John Van Mons; named for Dr. Wendell, of New York.
Werder. MinnH'76,43									Exhibited at the Centennial Exhibition by Robert Manning.
Wesner. NHH'87,32. Syn. Wesner's Early	Ark.		m	gyb			g-vg	ve	A very early variety from Arkansas.
Wesner's Early. CoOHS'87,68. Syn. of Wesner									
Wescott. MagofH'47,575,'48,109,'51,261. Hort'47,241,287. E'54,386,'59,414. D'57, 500,'69,879. F275. PaF871,'66. T'75,881,'85,299,'97,475.	R. I.	r	m	y	jmco	s	g	m	
Wetmore. D'69,879	N. Y.	rov	s	yru	jm	sp	g-vg	m	Raised by E. B. Wetmore, Westmoreland, N. Y.
Wetteren. L. Syns. Beurre de Wetteren, Beurre Wetteren	Belg.	t	m	ru	dmb	sp		l	Discovered by Louis Berckmans in his garden.
Wharton. L. Syn. Wharton's Early		obop	m	yru	jm	sp	g-vg	me	Dr. Kirtland received it from southern Ohio.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality	Season.	Remarks.
Wharton's Early. SW. E'54,'57,'59,414. D'57,560,'69,879. MagofH'57,518,'60,403. HHH'63,108. AHortA'70,77. Hort'66,171. T'75,557,'85,573,'97,717. Syn. of Wharton.									
Wheeler. MagofH'58,505. D'69,880. T'75,557,'85,573,'97,717	R. I.	robo	m	gyru	jm	s	g	me	Origin Greenwich, R. I.
Wheeler's New St. Michael. E'54,320,'59,356. Syn. of Dearborn Seedling									
Wheildon. AgR'64,127. Syn. of Whieldon.									
Whieldon. MassH'64,42. D'69,880. Syns. McLellan, Wheildon, Whieldon's McLellan.	Mass.	obtp	ml	ygrru	gjmb	sp	g-vg	me	Origin with W. W. Whieldon, Concord, Mass.
Whieldon's McLellan. D'69,880. Syn. of Whieldon									
[illegible]									
White. L. Syn. White's Seedling	Conn.	oval	m	ybru	jm	sp	g-vg	l	Originated at New Haven, Conn.
White and Gray Messire Jean. Pr82. Syn. of Messire									
White and Gray Monsieur John. Pr82. Syn. of Messire									
White Autumn. EFABC'00									In the experimental orchard at Agassiz, B. C.
White Autumn Beurre. GenF'33,196. D'45,378,'57,436,'69,880. HovII,85. E'54,322,'59,336. F224. AgR'62,183. Syn. of White Doyenne.									
White Beard. DomEncIV,189			s	yg	j	v			Grown in Europe for making perry.
White Beurre. GenF'33,196. Cult'44,56. D'45,378,'57,436,'69,880. HovII,85. E'54,322,'59,336. F224. AgR'62,183. T'97,717. Syn. of White Doyenne.									
White Butter. DomEncIV,185. GarCal587. HHH'68,311. Probably a syn. of White Doyenne.									
Whitecap. DomEncIV,189.		r		g			p		Good for perry.
White Dean. E'54,322,'59,336. AgR'62,183. Syn. of White Doyenne.									
White Doyenne. Cr43. Cult'39,66,'44,36. IndF'40,136,182. D'45,378,'57,436,'69,880. Cole165. G85. HovII,85. AgR'50,95. Hort'54,158'56,406. H201. F224. WnI,326,II,336,III,259. T'97,475. AHM268. Syns. A Courte queue, Bergoloo, Beurre Blanc, Beurre blanc, Beurre Blanc d'Automne, Beurre Doyenne Blanc, Beurre Doree, Beurre Du Roi, Blanc, Bonne-ente, Burgalue, Butter, Butterbirne, Butter Pear, Butter Pear (of Philadelphia), Carlisle, Citron de Septembre, Common Doyenne, Dean's, Dechantsbirne, Die Weisse Herbst Butterbirne, Doyenne, Doyenne Blanc, Doyenne blanc, Doyenne White, Edwige, Fall Butter, Garner or Gardner, Kaiserbirne, Kaiser d'Automne, Monsieur, Neige Blanche, Nouvelle d'Ouef, Passe Colmar d'Autumn Pine Pear, Poire de Limon, Poire de Neige, Poire de Seigneur, Poire de Simon, Poire du Doyen, Poire Monsieur, Poire Neige, Regnier, Reigner, St. Michael, Saint Michal blanc, St. Michael (of Boston), St. Michael (of New York), St. Michel, Saint Michel, Snow Pear, Sublime Garnotte, Valencia Valentia or Valencia, Virgalieu, Virgalieu (of New York), Virgaloo, Virgalue, Virgouleuse, Warwick Bergamot, Weisse Herbst Butterbirne, White Autumn Beurre, White Beurre, White Butter, White Dean, White Deschantsbirne, White or Autumn Butter, Yellow Butter.	Fr	obo	ml	wyr	bm	v	b	ml	Downing says: "Unquestionably one of the most perfect of autumn pears." Where the White Doyenne succeeds, it is always best. Unfortunately it cracks and is otherwise imperfect some seasons. Its numerous synonyms (63 all told) indicate its great popularity.

Whitefield. K'41,154. Syn. of Whitfield								
White Livland. Gb. CanExFR'96,136. Syn. Butterbirne Weisse Livlandische	Rus.							Introduced from Russia in 1882.
White Monsieur John. K'32,138. Syn. of Messire								
White or Autumn Butter. Pr43. D'69,880. Syn. of White Doyenne								
White Pear. Pr17. D'69,802. Syn. of Little Blanquet								
White Seckel. R. Syn. Foote's White Seckel	Mass.	p	s	yb	j		g		Origin at Williamstown, Mass., with A. Foote.
White's Seedling. MagofH'53,522. D'57,560,'69,881. F275. T'75,557,'85,573,'97,717. Syn. of White.								
White Templirs. L. Syn. Des Templirs blanc	For.							Published by Field, p. 279.
Whitfield. GenF'33,197. Cult'39,66. MagofH'40,391,'43,388,'50,296. MassH'45,88. A'54,240. E'54,400,'59,425. Syn. Whitefield.		obo	m	yb	bm		vg	m	
Whitmore. R. Syn. Whitmore Coreless								In the experimental orchard at Agassiz, B. C.
Whitmore Coreless. EFABC'00. Syn. of Whitmore								
Wicar of Wakefield. D'69,875. Syn. of Vicar								
Widow. Hort'51,504. E'54,388,'59,415. H201. Syn. of Wredow								
Wiert. F275. Syn. of Wiest								
Wiest. MagofH'52,492. D'57,560,'69,882. T'75,557,'85,573 '97,717. Syn. Wiert	Pa	rov	ms	gr	jm	sa	g	me	
Wilbeck. Cult'39,66								Not described.
Wilbur. MagofH'44,211. MassH'48,101. Hort'49,457. D'45,421,'57,461,'69,882, Cole157. B'51,309. E'54,386,'59,415. H201. F275. A'62,70. T'75,281,'85,299,'97, 475. Syn. Early Wilbur.	Mass.	rov	ms	yru	jm	a	g	me	Originated at Somerset, Mass.
Wild Bergamot. MichB31.								Not described.
Wilder. A'75,38. MassH'76,95. CanH'93,58. T'97,453. AHM268. Syn. of Col. Wilder.								
Wilder. A'87,95. OH'87,166. AgR'88 572. MoH'92,235. CanH'01,449,451,'05,343. FESofO'01,21. Syn. of Wilder Early.								
Wilder Early. CanH'89,286,'90 251. AofH'89,151. MoH'92,40. HAJ'90,39. AHM268 IndH'02,62. Syns. Early Wilder, Wilder, Wilder's Early.	N. Y.	p	sm	ybr		sa	vg	me	Originated in Chautauqua County, N. Y.
Wilder's Early. CanH'89,287. Syn. of Wilder Early								
Wilding (of Caissoy). Pr125. K'32,143. D'69,700. Syn. of Caissoy								
Wilding (of Echassery). Pr124. Syn. of Echasserie								
Wilding (of Hery). Pr36. D'69,700. Syn. of Heri								
Wilding Von Motte. MHSC'82,58. FGAofO'83,222. Syn. of La Motte								
Wild Pear. MassH'93,297. Syn. of Volga								
Wilfred. D'69,683. Syn. of Autumn Hardenpont								
Wilcommine. F277. Syn. of Amanlis								
Wilhelmina. K'41,166. D'45,451. Cole173. E'54,387. H203. Syn. of Jaminette								
Wilhelmine. D'45,451,'57,513. E'54,387,'59,392. FGAofO'71,33. Syn. of Jaminette								
Wilkinson. K'32,178. M'38,86,'44,73,'47,75. D'45,421,'57,561,'69,882. MagofH'54, 470,559. B'51,309. E'54,388,'59,415. H202. F275. T'75,281,'85,299,'97,475. MHSC-'76,30. HMHS222. L19.	R. I.	ov	m		jm	sp	g	ml	Exhibited at meeting of Massachusetts Horticultural Society, November, 1829.
Wilkinson Winter. R. Syn. Wilkinson's Winter	Ill.							Originated at Peoria, Ill. See Transactions Illinois Horticultural Society, 1876, p. 113.
Wilkinson's Winter. IllH'76,113'80,83,131. IaH'82,175,'94,169. MichB31. Syn. of Wilkinson Winter.								
Willermoz. MassH'53,21. MagofH'54,86,461. D'57,561,'69,882. F283. E'59,415. Hort'63,161,'72,38. OH'65,41. FGAofO'70,20. T'75,290,'85,308,'97,481.	Belg.	obtp	l	gyru	jmco	v	g-vg	l	Originated in 1848,
William. Cult'45,175. Syns. William Edwards, William (Edwards)	Conn.	obtp	m	yrru	b	s		me	Raised by Governor Edwards, of New Haven, Conn.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
William. D'69,805. Syn. of Louise									
William Edwards. D'45,420,'57,584,'69,882. T'75,557,'85,573,'97,717. Syn. of William.									
William (Edwards). MagofH'45,252. E'54,400,'59,425. Syn. of William									
William Fuller. GarM'85,302. Syn. of Fuller									
William Powell. D'69,863. Syn. of Bon Chretien (Sum.)									
William Prince.. MagofH'51,472. F283. D'69,883		rp	m	gyeru	jm	s	g-vg	m	
Williams. K'32,178. Syn. Belle Williams		oblp	ml	yru	j	p	g	vl	But little known in this country.
Williams. Hov11,11. E'54,311,'59,324. F276. AgR'62,179. Syn. of Bartlett									
Williams' Bon Chretien. Pr137. K'32,159,'41,154. GenF'37,277. M'38,67,'44,52. Cult'39,66. IndF'40,105,111,182. MassH'44,58. D'45,334,'57,421,'69,666. Cole156. NAPC'49,8. B'51,299,'83,362. Hort'53,350. E'54,311,'59,324. G83. AgR'62,179. T'75,557,'85,573,'97,717. Syn. of Bartlett.									
Williams d'Hiver. AJofHIX,219	Eur.							l	From Gardener's Chronicle.
Williams (Doub.). L. Syn. Williams's Double Bearing	Mass.		l		m			m	
Williams's Double Bearing. Pr215. MagofH'37,51. Syn. of Williams (Doub.)									
Williams' Early. MagofH'37,51,'48,344. M'38,70,'44,53. K'41,154. D'45,348,'57,560,'69,883. Cole160. MassH'48,99. E'54,386,'59,415. H201. F275. T'75,557,'85,573,'97,717. Syn. of Early Williams.									
Williams Melting. MagofH'40,391									Not described.
Williamson. Hort'51,494. E'54,386,'59,415. D'57,560,'69,883. F275. T'75,557,'85,573,'97,717. Syn. Williamson's Virgouleuse.	N. Y.	rob	m	ygru	cojm		g	m	Originated by N. Williamson, of Long Island, New York.
Williamson's Virgouleuse. C210. Syn. of Williamson									
Williams Victoria. EFABC'00									In the experimental orchard at Agassiz, B. C.
Williams Virgalouse. H202		r	l	g			g	l	
Williams Winter. EFABC'00. CanExFR'02,380		obtp	m	gyru	jm			l	In the experimental orchard at Agassiz, B. C.
William the Fourth. K'41,148. D'45,397,'57,520,'69,805. Hov,39. E'54,330,'59,345. F218. Syn. of Louise.									
Willirmoz. HHH'69,155									Probably the same as Willermoz.
Wilmington. A'56,90,'64,60,'99,15. AgR'56,369. MagofH'57,109. Cult'57,141. Hort'57,111,'64,147. D'57,561,'69,883. F275. E'59,416. CGenIX,191. T'75,268,'85,286,'97,465. B1228.	Pa	obtp	m	gyru	jbm	sp	g-vg	me	Raised by Dr. Brinckle from seed of Passe Colmar.
Wilmot. FGAofO'93,146,'95,33. CanExFR'96,136	Can.		m				g	me	Described by E. E. Beaman, of Newcastle, Ontario.
Wilsons. SW									Cultivated by Silas Wharton in 1824.
Windsor. Pr155. K'32,133,'41,118. GenF'37,277. MagofH'37,49. D'45,347,'57,585,'69,883. Cole154. AgR'54,263. E'54,400,'59,425. H201. F283. A'62,70. HHH'63,108. AJofHVI,299. T'75,557,'85,573,'97,717. Syns. Bell, Belle d'Ete, Bellissime, Bell Tongue, Cuisse Madame, Cuisse Madame (of the French), Early Bell (of New England), Ennes (of Kentucky), Green Windsor, Grosse Jargonelle, Konge, Lady Thigh, Madame, Madame de France, Smith's Superior, Suisse Madame, Summer Bell, Supreme, Watermelon (of some), Water (of some).	Eur.	p	ml	yg	deoj	a	p	ve	Only desirable for early and near markets.

Winkfield. AgR'50,95. MichH'70,66. Syn. of Vicar									
Winship. E'54,386,'59,416. F275. D'69,884. Syn. Winship Seedling	Mass	oblp	m	gyru	co		p	me	Originated by the Messrs. Winship, Brighton, Mass.
Winship Seedling. MagofH'44,212,'47,485. E'54,386,'59,416. D'69,884. T'75,557,'85, 573,'97,717. Syn. of Winship.									
Winslow. MassH'66,45	Mass								Origin Brookline, Mass. Fruited in 1865.
Winter. Gb. IaB3. CanExFR'96,136. Syn. Osimaya	Rus								Introduced from Russia in 1879.
Winter Ambret. Pr122. D'69,658. Syn. of Ambette									
Winter Baking. Th193. HHH'69,240. Syn. of Baking									
Winter Bartlett. GCR. OreH'95,42. CanExFR'95,392. HHH'95,303,'96,204. EFABC'00. Syn. Late Bartlett.	Ore	oblp	l	y	jm	v	vg	l	Originated at Eugene, Oreg.; introduced by G. C. Roeding.
Winter Bell. D'45,445,'57,537,'69,835. E'54,334,'59,346. A'62,70. L18. T'97,717. AHM259. Syn. of Pound.									
Winter Bergamot. Pr99. Syn. of Colmar									
Winter Bergamot. GenF37,278. D'45,429,'57,564. K'41,124. H203. F277. HHH'68, 311. T'75,557,'85,573,'97,717. Syn. of Easter Bergamot.									
Winter Bergamotte. C206. Th186. E'54,389,'59,417. Pr77. H203. D'69,751. Syn. of Easter Bergamot.									
Winter Beurre. Th186. Pr94. GenF'33,196. Cult'39,66. D'45,433,'57,569,'69,718. E'54,359,'59,372. F279. H142. T'97,717. Syn. of Chaumontel.									
Winter Beurre. F214. Syn. of Easter Beurre									
Winter Beurre (Rivers). D'69,843. Syn. of Rivers									
Winter Bon Chretien. GarCal787. Pr92. K'32,143,'41,125. GenF'37,278. Cult'39,66. D'69,884. Syn. of Bon Chretien (Win.).									
Winter Butter. C200. Pr94. T'85,305. Syn. of Chaumontel									
Winter Crassanne. K'32,199,'41,166. GenF'33,196. Cult'39,66. MagofH'50,296. A'54,240. Syn. of Bruneau.									
Winter Cross. D'45,432. E'54,360,'59,375. H145. Syn. of Cross									
Winter Dechantsbirne. AofH'91,296. Syn. of White Doyenne									
Winter Duchesse. D'69,749. OH'88,49,102. Syns. Duchesse d'Hiver, Tardine de Toulouse.	Fr	obop	l	ybm	jd	s	vg	vl	Originated by M. Barthere at Toulouse, France.
Winter Forelle. EFABC'00									In the experimental orchard at Agassiz, B. C.
Winter Franc Real. Cole174. L16. Syn. of Franc Real (Win.)									
Winter Good Christian. Th193. D'69,884. HMHS43. Syn. of Bon Chretien (Win.)									
Winter Green Long. Pr124. D'69,753. Syn. of Echasserie									
Winter Jonah. NHH'89,214. AndN'95. EFABC'00. CanExFR'03,422		r	m	gb				l	In the experimental orchard at Agassiz, B. C.
Winter Long Green. Pr124. K'32,144. D'69,753. Syn. of Echasserie									
Winter Milan. L. Syn. Beurre Milan d'Hiver	For								Published by Field, p. 278.
Winter Nelis. Pr132. K'32,199,'41,167. GenF'33,197. MagofH'37,197. M'38,92,'44, 84,'47,85. D'45,450,'57,447,'69,884. Cult'44,36. Cole172. G85. Wg75. E'54,346,'59, 355. B'51,311,'84,377. H202. F205. T'75,291,'85,309,'97,482. WnI,327,II,338,III,259. Syns. Bergamotte Thouin, Beurre de Malines, Beurre Thouin, Bonne de Malines, Bonne Malinoise, Colmar d'Hiver, Colmar Nelis, Esturion, Etourneau, La Bonne Malinoise, Malines, Milanaise Cuvelier, Nelis d'Hiver, Nelis Winter, Thouin.	Fl	robo	ms	ygru	bmj	sp	b	l	Originated by M. Nelis, Mechlin, Flanders.
Winter Oken. D'69,822. Syn. of Oken									
Winter Orange. SW. Pr41. K'32,146,'41,125. IndF'40,136. MagofH'50,296. A'54, 240. E'54,401,'59,425. D'57,579. F281. Syns. L'Orange d'Hyver Orange d'Hiver, Orange d'Hyver.			m					l	Only fit for the kitchen.

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Winter Pear. MagofH'54,75. TexB16.		r	m	y			g	l	An indefinite name; perhaps of no value.
Winter Perfume. L. Syn. Parfum d'Hiver	For								Published by Field, p. 282.
Winter Queen. DomEncIV,181. Syns. La Reine d'Hyver, Queen of Winter, Reine d'Hiver.		rob	s	ybru	jm	s	g	m	
Winter Quince. MassH'48,99. A'54,240									Shown by Robert Manning at meeting of Massachusetts Horticultural Society in 1848.
Winter Rousselet. L. Syns. Rousselet d'Hiver, Winter Russet									Not described.
Winter Rousselette. Pr21. H202. D'69,814. Syn. of Sec									
Winter Royal. C202. Pr81. H185. D'69,848. Syn. of Royal Winter									
Winter Russelet. Pr21,58. Syn. of Sec									
Winter Russet. K'32,153,'41,128. Syn. of Winter Rousselet									
Winter St. Germain. Cult'39,66. Syn. of Saint Germain									
Winter Scotch. ColoH'87,418								l	Said to be fine in Colorado.
Winter Seckel. D'57,562,'69,885. F275. E'59,416. Hort'74,318. T'75,557,'85,573,'97,717.	Va	obo	s	ybru	cojm	s	g	vl	Origin near Fredericksburg; introduced by H. R. Roby.
Winter Seckel. WnI,327,II,337,III,259. Syn. of Danas Hovey									
Winter Sylvanche. Pr214. Syn. of Sylvange									
Winter Thorn. DomEncIV,185. C199. Th193. Pr105. Cult'39,66. K'41,122. D'69,885. EFABC'00. Syns. Epine d'Ete, Epine d'Hiver, Epine d'hyver, Epine Rose d'Hiver.		robo	m	ygb	db	sp		l	From Hogg's Fruit Manual.
Winter Vergalieu. D'45,434,'57,570,'69,723. Cult'47,340. F279. Syn. of Colmar									
Winter Virgalieu (erroneously). Pr87. Syn. of Virgouleuse									
Winter Windsor. K'41,130									Not described.
Wisner. Hort'56,184. Hof. D'69,855. Syn. of Sheldon									
Witte. L. Syns. Beurre de Hamptienne, Dial, Jean de Witte, Nos. 1082, 1482, and 1602 of Van Mons, Passe Colmar Francois.		robop	m	ygeru	jm	s	g-vg	l	
Witzhumb. L. Syns. Beurre Witzumb, Beurre Witzcomb, Beurre Witzhumb		ov	l	gbr	m	p		l	
Wolaston. AgR'56,368. T'75,557,'85,573,'97,717. Syn. of Glout Morceau									
Wolcott's Early. D'69,779. Syn. of Harvest									
Wollaston. A'52,94,'56,90. Syn. of Glout Morceau									
Wonder of Winter. C198. Pr106. K'32,147,'41,122. H175. Syn. of Merveille									
Wood. L. Syns. Monstrous Wood, Nain Vert	For								Published by Field, p. 281.
Woodbridge. L. Syns. Seedling Seckel, Woodbridge No. 2, Woodbridge Seckel	Mich	ovp	s	yeru	jm	sv	vg	me	Originated at Detroit, Mich.
Woodbridge No. 1. A'60,121. [Perhaps not named and disseminated.]									
Woodbridge No. 2. A'60,121. Syn. of Woodbridge									
Woodbridge No. 3. A'60,121. [Perhaps not named and disseminated.]									
Woodbridge No. 4. A'60,121. [Perhaps not named and disseminated.]									
Woodbridge Seckel. A'62,123. D'69,885. Syn. of Woodbridge									
Woodstock. A'56,201. E'59,416. Hort'60,244. D'69,886	Vt	robtp	ms	yru	jm	sp	g-vg	me	Originated in Vermont.
Woolaston. D'69,773. Syn. of Glout Morceau									

Worcester. L. Syns. Black Pear of Worcester, Black Worcester, Iron, Parkinson's Warden.		oblp	l	gru	co		g	l	Only desirable for the kitchen and market.
Worden. AofH'90,203. Syns. Worden's Meadow, Worden (Seckel), Worden's Seckel.	N.Y.	obtp	m	ybr	m	sv	vg	me	Worden's Meadow may be distinct. See Cultivator, 1845, p. 340.
Worden's Meadow. Cult'45,340. Syn. of Worden.									
Worden (Seckel). L. St. BBL. Syn. of Worden.									
Worden's Seckel. AJofH'91,296,'92,277. C(O)HS'91,147. CtP'03,13. T'97,465. AHM268. Syn. of Worden.									
Wormsley. L. Syn. Wormsley Grange.	Eng.	obl	m	yb	b			m	
Wormsley Grange. K'32,178,'41,130. GenF'33,197. MagofH'43,132. Syn. of Wormsley.									
Woronson. L. T'97,717. Syns. Beurre Woronson, Beurre Woronzon, Beurre Woronzow.			m	y				m	Thomas says: "Very productive."
Wredon. MagofH'40,390. Syn. of Wredow.									
Wredow. MagofH'52,474,'53,102,'56,226. E'54,388,'59,415. D'57,562,'69,886. F283. PaFS'71,66. T'75,557,'85,573,'97,717. Syns. Wiedow, Wredon.	Fr.	obop	m	gyeru	jm	v	g-vg	me	
Wredow. Dap155. A'75,68. Syn. of Charles Delight 1st.									
Wright. R. Syn. Wright's Monarch.									Possibly a misprint for Knight (K. Monarch).
Wright's Monarch. IaH'84,509. Syn. of Wright.									
Wright Pear. OH'85,177. Syn. of Craig.									
Wurmskale. MassH'44,60.									Shown by Josiah Lovill, of Beverly, Mass.
Wurtemburg. MagofH'37,36. IndF'40,182. K'41,145. WHRH,554. Syns. Beurre de Montgeron, Capiamont (of Boston), Frederic de Wurtemburg, Frederick de Wirtemberg, Frederick of Wurtemburg, Frederic of Wurtemburg, King of Wurtemburg, Medaille d'Or, Rio de Wurtemburg, Summer Vermilion, Sylvestre d'Automne, Sylvestre d'Hiver, Vemulen d'Ete, Vermillon d'Ete.	(?)	p	l	yeru	jm	s	g	me	Authors differ in regard to its origin.
Wurtemburg (incorrectly). GenF'33,197. D'45,401,'57,526. F281. Syn. of Napoleon.									
Wurtzer. R. Syn. Wurtzer d'Automne.									Rejected by Congress of Fruit Growers, 1849.
Wurtzer d'Automne. MagofH'50,296. Syn. of Wurtzer.									
Wurzur. E'54,401,'59,425. Syn. Wurzur d'Automne.	Eur.	p	m	yru				ml	Probably same as the preceding.
Wurzur d'Automne. MassH'45,88,'48,99. A'54,240. E'54,401,'59,425. Syn. of Wurzur.									
Yair. L. Syns. Grand Monarque, Green Pear of Yair, Green Yair.	Eur.	obo	m	g	j	p	g	me	Has not proved valuable in America.
Yale. A'58,92. Syn. Ives' Yale.	Conn.	r	m	gybru	j		g	e	Raised by Dr. Eli Ives, New Haven, Conn.
Yat. Pr194. MagofH'43,130. D'45,422,'57,585,'69,886. E'54,401,'59,425. F283. Hort'72,292. T'75,558,'85,573,'97,717. EFABC'00. CanExFR'03,421. Syns. Beurre Gris d'Ete, Bust, De Hollande, Graue Sommer Butterbirne, Gute Graue, Jutjesbirne, Jutte, Jut peer, Yut, Yutte.	Hol.	obop	s	ybru	dj	s	p	me	
Yat or Yut Pear. Pr124. Syn. of Echasserie.									
Yellow Butter. SW. K'41,121. D'45,378,'57,436,'69,880. E'54,322,'59,336. F224. AgR'62,183. T'75,558,'85,573,'97,717. Syn. of White Doyenne.									
York. L. Syn. Early York.	Conn.	obtp	ml	y			g	e	Published by Field, p. 273.
York Bergamot. Pr71. K'32,133. GenF'33,196,'37,227. D'45,366,'57,565,'69,663. E'54,389,'59,417. F277. T'75,558,'85,573,'97,717. Syn. of Bergamot (Aut.).									

Catalogue-index of the known varieties of pears referred to in American publications from 1804 to 1907—Continued.

Name of pear.	Origin.	Form.	Size.	Color.	Texture.	Flavor.	Quality.	Season.	Remarks.
Yat. Pr194. Syn. of Yat.									
Yutte. MassH'44,61. K'41,155. D'45,422,'57,585,'69,886. MagofH'50,296. E'54,401, '59,425. A'54,240. F283. Hort'72,292. CanExFR'03,421. Syn. of Yat.									
Zache. St. MichB177,187,194.		robl	m	yr	g		p	ml	
Zaharna. FGAofO'83,223. Syn. of Sugar.									
Zappa. R. Syn. Bergamot Zappa									Published in Magazine of Horticulture, 1851, p. 473, as B. Zappe.
Zarskaja. IaH'80,61	Rus.?								Not described.
Zephirin Gregoire. MagofH'53,10,'54,462. Hort'53,30,'54,78,'61,318. AgR'54,245. E'54,388,'59,416. WHRII,560. D'57,562,'69,886. Cult'58,13. CGenX,398. T'75,294, '85,312,'97,485. MVHS'83,131. Syns. Zephyrin Gregoire, Zephyrin Louis Gregoire.	Belg.	rp	m	gyrru	mj	p	g-vg	m	Originated by M. Gregoire, of Jodoigne, Belgium.
Zepherin Louis. D'69,886. Syn. Zepherin Louis Gregoire	Belg.	robo	m	gybru	mj	sp		l	Raised by M. Gregoire.
Zepherin Louis Gregoire. D'57,562,'69,886. E'59,416. T'75,558,'85,573,'97 718. Syn. of Zepherin Louis.									
Zephyrine Gregoire. F283. Syn. of Zephirin Gregoire									
Zephryin Louis Gregoire. F283. Syn. of Zephirin Gregoire									
Zoar. AgR'54,263. Syns. Zoar Beauty, Zoar Seedling, Zoar Superb	Ohio	ap	m	yeru	gj	sp	g	e	
Zoar Beauty. MagofH'47,110. E'54,347,'59,356. D'57,562,'69,887. H204. F275. A'60,205. HH'63,108. CGenXVI,174. T'75,558. Syn. of Zoar.									
Zoar Flat. E'54,401,'59,425. F275.	Amer	obo	s	g				m	
Zoar Seedling. Cole152. E'54,347,'59,356. D'57,562,'69,887. Syn. of Zoar.									
Zoar Superb. WHRIV,164. Syn. of Zoar.									
Zoe. FGAofO'83,72. GHM&S'90. CNC'93. AndN'95. CanExFR'96,136. EFABC'00.		obl	l	gbr	m		g	l	Described by California Nursery Co., 1893, p. 15.
Zucherbirne. Gb. FGAofO'83,223. CanExFR'96,136. EFABC'00. AHM268. Syn. of Sugar.									
Zucherbirne Grosse. Gb. Syn. of Large Sugar									
Zugler. L. Syn. Van Zugler	Belg.	rp	m	yeru	jm	sp	vg	me	
Zurich. L. Syn. Sucre de Zurich	For.								Published in Magazine of Horticulture, 1843, p. 131.
Zurick. L. Syn. Beurre de Zurick	For.								Published by Field, p. 278.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 127.

B. T. GALLOWAY, *Chief of Bureau.*

THE IMPROVEMENT OF MOUNTAIN MEADOWS.

BY

J. S. COTTON,
SCIENTIFIC ASSISTANT, FARM MANAGEMENT INVESTIGATIONS.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., January 17, 1908.

Sir: I have the honor to transmit herewith a paper entitled "The Improvement of Mountain Meadows," by Mr. J. S. Cotton, of the Office of Farm Management Investigations of this Bureau, and recommend its publication as Bulletin No. 127 of the Bureau series.

Experiments in reseeding mountain meadows were begun by this Bureau in 1902 and have been continued since that time. The results obtained enable us to draw a number of important conclusions concerning the practicability of reseeding ranges at high elevations in our Western States. Our experience also enables us to determine fairly accurately the cost of reseeding, the best manner for doing the work, and the resulting increase in the carrying capacity of the ranges. It is rather a striking circumstance that the only results of value that have been secured in these experiments have been with the ordinary tame grasses. Generally speaking, native grasses and forage plants have seed habits which render their artificial propagation on the ranges impracticable. Mr. Cotton has shown that mountain meadows may be reseeded at an expense which is commensurate with the returns to be secured.

The information contained in this bulletin should be of value to those who own ranges in the mountains or are responsible for their administration.

Respectfully,
B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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THE IMPROVEMENT OF MOUNTAIN MEADOWS.

INTRODUCTION.

For a number of years the Bureau of Plant Industry has been carrying on investigations to determine what can be done to improve the stock ranges that have become badly depleted through overgrazing. In this work considerable attention has been paid to the grazing conditions in the mountains where the problem of summer pasturage is of very great importance in the production of beef and mutton.

A careful study of the conditions involved in these areas has led to two general conclusions: (1) On the mountain ridges, where the soil is usually very shallow and close to bed rock and is of a more or less sterile nature, very little can be accomplished in the way of range improvement. While reseeding may sometimes prove practicable, such improvement must ordinarily come through careful protection from overgrazing, in order that the original vegetation may be given a chance to restore itself. (2) In the mountain meadows and park-like areas, where there is ordinarily a good, rich, loamy soil, there are very great opportunities to increase the quantity of feed produced, and this increased production can very largely be secured by reseeding.

In connection with these investigations a range experiment station was established in the Wenache Mountains in Washington State in the fall of 1902, at which time seeding experiments were begun. These experiments were carried on cooperatively by the Washington Agricultural Experiment Station and the Bureau of Plant Industry. The following year other experiments were undertaken in the Sierra Nevada Mountains, California, the latter being under the direct charge of Mr. Charles H. Shinn, supervisor of the northern district of the Sierra National Forest. In 1906 further experiments were begun in the Warner Mountains in northeastern California, under the care of Forest Supervisor A. H. Hogue. In addition to these experiments numerous observations have been made on the results obtained by stockmen in various parts of the country in their efforts to improve the mountain grazing areas.

WENACHE MOUNTAIN STATION.

The Wenache Mountain station is located on the summit of the mountains, some 26 miles northeast of Ellensburg, and is at an altitude of a little more than 5,300 feet. It is highly typical of the entire mountain region along the eastern slopes of the Cascades in Washington. Practically all the different soil and climatic conditions found in this region are represented at the station or within a very few miles of it. The annual precipitation is probably not far from 20 inches and comes largely in the form of snow. The growing season does not much exceed four and a half months. The snow goes off some time between May 20 and June 1. The ground is usually frozen by the middle of October and snow falls to stay soon after November 1.

The station lies in the general course traveled over in the spring by the numerous migratory bands of sheep in going from the desert or lowland ranges to the high mountain pastures in the Cascades, and again in September on their return to the lowlands. As a result the region had been severely overgrazed for a number of years and the vegetation was in a badly depleted condition, much of it having been completely exterminated.

The station comprised a section of land that Babcock & Benson, the owners of a large sheep and cattle range, had inclosed with a good stock-proof fence as a holding pasture for their saddle and pack horses. As the problem of increasing the quantity of feed in the high mountain meadows was one of great importance to them, they donated the use of this section for experimental purposes. These men endeavored to keep out all stock from this area during those periods of the year when grazing might injure the grasses in the various plots, and in other ways did all they could to make the work successful.

SEEDING EXPERIMENTS.

The establishment of experimental plots at the Wenache Mountain station covered a period of two years. The first seeding was done in the latter half of October, 1902. The seed was sown so late in the season that there was no danger of its germinating that fall and yet in plenty of time for it to be on the ground before the snow, which began falling about two days after the seeding was finished. The melting snows in the spring tended to carry the seed into the ground and thus to insure germination.

Approximately 26 acres were seeded, plots of timothy, Kentucky bluegrass, redtop, mountain brome-grass (*Bromus marginatus*), and white clover being started. In the spring of 1903 a little more than 30 acres were seeded. The same grasses were sown and a number of others, as follows: Orchard grass, brome-grass (*Bromus inermis*), cheat (*Bromus secalinus*), Italian rye-grass, perennial rye-grass, tall fescue, hard fescue (*Festuca duriuscula*), sheep's-fescue (*Festuca ovina*), Canada bluegrass, red clover, and alsike clover. The conditions at that time were highly favorable. The ground was covered with snow until June 1, 1903. On June 5 a warm wave swept over the eastern part of the State. This took the snow off very rapidly. The top of the ground dried out very quickly and it was necessary to cover the seed by means of a light harrow in order to insure germination. Later there were frequent showers which kept the ground moist and in excellent condition. By July 4 most of the plats were showing signs of germination. The majority of the grasses mentioned were again tested in the fall of 1903, a little more than 20 acres being seeded in the first half of October.

This completed the main part of the seeding, although in the fall of 1904 additional plots of tall fescue and orchard grass were started in order that the data obtained might be extended, while new plots of a few other grasses were established. The new plots were of slender wheat-grass (*Agropyron tenerum*), western wheat-grass (*A. occidentale*), tall oat-grass, and a native variety of sheep's-fescue (*Festuca ovina ingrata*).

In addition a number of plots were started on an area that had been plowed in the spring of 1904, the object being to determine how much value plowing has in the introduction of cultivated grasses in mountain areas.

MANAGEMENT OF STATION.

During the season of 1903 the proprietors of the land took a great deal of pains that all stock should be kept off the section until late in the fall. In the season of 1904 some 20 head of saddle horses were allowed to graze at the station from about the middle of June, the beginning of the growing season, until the first of November. Late in the autumn the station was also used for a few days at a time as a holding pasture for beef steers. Although the plots were very closely grazed in the late fall no harm was done them.

In June, 1905, the property changed hands, Coffin Brothers, who hold very extensive sheep interests in the State, purchasing it. These men very kindly offered to protect any part of the experiments that the Bureau of Plant Industry might desire. As all the seeding had been completed and the plots were well established, it was thought best to have them regularly grazed and learn how the different grasses stood pasturing. Since that date the section has been grazed in about the same manner as formerly. No further attention has been paid to it by the Department of Agriculture than to make yearly observations as to the growth and pasturage qualities of the different grasses.

GRASSES TESTED.

Timothy.—Timothy was sown several times and under as many different conditions as possible, in order to give it a thorough test, 17 acres being seeded. Some of it was broadcasted on bare ground without further treatment, some was broadcasted and harrowed in, while a small quantity was sown on plowed ground. The quality of soil on which the seed was sown varied from a sterile side-hill soil, consisting largely of coarsely disintegrated basalt, to a good, rich, black loam. The rate of seeding was from 10 to 12 pounds to the acre.

On the half of the original plot started in the fall of 1902 where the seed was covered an excellent stand was secured. Had it been cut for hay it would have yielded in 1904 not less than 1½ tons per acre. It has been grazed quite extensively, especially in the fall, ever since the first year and it stood this grazing well until the season of 1906, when in some parts of the plot it seemed to be dying out. In 1907 it had entirely recovered and was doing fully as well as ever. (See Pl. II, fig. 2.) The stand on the unharrowed half of the plot was at first only about a fifth as good as on the other. By a natural process of reseeding, the stand on the greater portion has gradually thickened, until at the present time it is fully as good as that on the first half. The timothy sown in the spring of 1904 without covering failed for the most part to germinate. Where it was harrowed in, a fair stand was secured, but one that was in no way comparable with that on the area seeded and harrowed the previous fall. Here, also, the timothy has reseeded itself until the stand is now as good as can be desired. In 1907 these three plots, aggregating some 7 acres, would have cut fully 1½ tons of hay to the acre.

Half an acre of timothy was tested on the plowed ground. A good stand was secured, but it was no better than where the seed had been broadcasted and harrowed in.

Redtop.—A little more than 10 acres of redtop was sown in various parts of the section under practically the same conditions as the timothy. The rate of seeding was from 8 to 14 pounds to the acre. The first two years after seeding very little of this grass could be found, and except in a few scattered places the growth seemed to be unsatisfactory. By the summer of 1905 the stand had thickened greatly, there being on some areas a good sod where the first year after seeding there was apparently nothing to be seen. By the year 1906 the stand on the greater part of the original plots was good. (See Pl. III, fig. 1.) The grass was then making an excellent growth and in many places was crowding out much of the original native vegetation. The redtop sown on the plowed area likewise gave an excellent stand and has done well. It is doubtful, however, whether the time saved in getting a stand of this grass would warrant the extra cost of plowing and preparing the land.

Tall fescue (*Festuca elatior*).—In the spring of 1903 an acre of tall fescue was seeded on good loamy soil where the original vegetation had been largely destroyed, its place being taken by yarrow and annual weeds. The rate of seeding was 24 pounds to the acre. This plot was duplicated the following fall. In the autumn of 1904 half an acre of the plowed ground was seeded to this grass. On half of each of the plots the seed was covered by harrowing. On those areas that were harrowed, a good stand has been secured and the grass has made an excellent growth. Tall fescue ranks next to timothy and redtop in value.

Orchard grass.—One and one-half acres of unprepared ground were seeded with orchard grass in the spring of 1903 at the rate of 24 pounds to the acre, the seed being harrowed in. In addition to this plot an area of one-sixth of an acre was seeded under similar conditions in the fall of 1904, while half an acre of plowed ground was seeded. The stand on the plowed area was quite satisfactory, but on the unprepared soil it was very poor. While it has been almost impossible to get a good stand, the orchard grass that came up has made a very satisfactory growth.

Brome-grass (*Bromus inermis*).—Two and one-half acres were seeded in the spring of 1903 on a rich, loamy soil, the rate of seeding being 22 pounds to the acre. One-half of the plot was harrowed. Where the seed was covered an excellent stand was secured. By the summer of 1905 the stand had thickened greatly, there was an excellent sod, and the grass was beginning to spread over some of the adjoining areas where there was a good soil. By the summer of 1906 it seemed to have disappeared in places in the main body of the plot, while along the edges it appeared to be getting much more abundant. In 1907 there was an excellent stand on nearly the entire plot.

Mountain brome-grass (*Bromus marginatus*).—About 6 acres were seeded to mountain brome-grass at a rate of 25 to 30 pounds to the acre. As this grass is a native of these mountains and naturally grows on the loose, gravelly soil areas, the plots were located on such areas. Where the soil was very poor a stand as satisfactory as could be expected was obtained. On a plot of one acre where the soil was somewhat coarsely disintegrated and where the seed had been harrowed in, a stand was secured that, if cut for hay, would have yielded not less than three-fourths of a ton of hay per acre. (See Pl. III, fig. 2.) Considerable seed has been collected from this plot for experimental uses in other places. One-half acre of this grass was tested on plowed ground. The stand on the plowed area was no better than that secured on the original plot, where the seed was merely harrowed in. The stock on the section have never grazed this grass to any extent, as there were other grasses that are much more palatable growing near it.

Cheat (*Bromus secalinus*).—One acre was seeded to cheat in the spring of 1903 on an open park-like area where the soil was a good black loam and where mountain clover (*Trifolium longipes*) formed the prevailing vegetation. The rate of seeding was 30 pounds to the acre. The plot was duplicated in the fall. The grass seed germinated well where it was harrowed in, but the grass made a very poor growth and by the season of 1907 had entirely disappeared.

Kentucky bluegrass.—Eleven acres were seeded to Kentucky bluegrass at three different seasons, the rate of seeding varying from 14 to 18 pounds to the acre. Except for a small plot of about one-tenth acre on plowed ground this grass made almost no growth until the summer of 1906. At the time it was apparent that the grass had started in occasional small patches and was making a fair growth and furnishing a little pasturage. The indications were, however, that it would be of very little value.

Canada bluegrass.—A little more than 3 acres was sown to Canada bluegrass in the spring and fall of 1903, the rate of seeding varying from 20 to 25 pounds to the acre. The grass was seeded in an open park-like area where the soil was for the most part a rich black loam. One-half of each plot was harrowed. A fair stand was secured on the area that was harrowed, but until the season of 1906 it made a very poor showing. By that time the stand had greatly improved and the grass seemed to be making a much better growth than in previous years. This grass will, however, be of very little value in mountain meadows.

Perennial and Italian rye-grasses.—Some two or more acres were seeded to each of these grasses in the spring and fall of 1903. The conditions under which they were sown were typical of the majority of the plots at the station. In both cases the stand secured was poor. Both grasses made very little growth and soon ran out. They seem to be totally unadapted to this region.

Hard fescue (*Festuca duriuscula*).—About 2 acres were seeded to hard fescue in an open park in the spring and fall of 1903. In addition, a small plot of one-sixth acre of plowed ground was seeded. No traces of this grass could be found on the main plot. The stand secured on the plowed ground was excellent at first, but the grass has been gradually running out and by the summer of 1907 there was very little left.

Sheep's-fescue (*Festuca ovina*).—Some 3 or 4 acres were seeded to this grass during the spring and fall of 1903, 16 pounds of seed being used to the acre. A fair stand was secured, but the grass does not seem to have done very well. In fact, it has not made nearly the growth that is made by a variety of sheep's-fescue (*Festuca ovina ingrata*) native in these mountains.

Native sheep's-fescue (*Festuca ovina ingrata*).—One-fourth of an acre was seeded to this grass in the fall of 1904. This grass, locally known as bunch bluegrass, is a native of the Wenache Mountains and the seed was hand gathered. The rate of seeding was 16 pounds to the acre. Apparently the seed never germinated.

Slender wheat-grass (*Agropyron tenerum*).—In the autumn of 1904 a plot of one acre of this grass was sown in an area where all the original vegetation had been destroyed by overgrazing and trampling and where yarrow and weedy annuals had become quite abundant. The seed was harrowed in. In addition to this, a plot of about one-fourth of an acre of plowed ground was seeded. The grass on the acre plot started very slowly, and even in the summer of 1906 seemed to be a failure. By 1907 it had become much more abundant, and although the stand was still quite poor it looked promising. A very good stand was secured on the plowed area and the grass has made a satisfactory growth. In the summer of 1907 it was estimated that this plot would have yielded, if cut for hay, a crop of nearly three-fourths of a ton to the acre. The experiments indicate that this grass may have some value in reseeding some of the hillside areas of the mountain regions. They will, however, need to be continued two or three years more before definite conclusions can be reached.

Western wheat-grass (*Agropyron occidentale*).—Two small plots were seeded to this grass in the fall of 1904 one on plowed ground and one on an area with good soil where the original vegetation had been destroyed by overgrazing. The seed failed to germinate on the unprepared ground. A fair stand was secured on the plowed area, but it has not made a very thrifty growth. This grass will probably be of no value in the high mountains.

White clover.—About 10 acres were seeded to white clover under conditions identical with those found on the timothy and redtop plots. The rate of seeding was from 8 to 12 pounds to the acre. Very few signs of germination of this seed have ever been found. In view of the fact that an excellent stand was secured from this same seed on the Cooke & Bull holding pasture two years later, the blame for this can not be placed on the quality of the seed. Various observations would indicate that the failure of this plant was probably due to lack of the proper kind of nitrogen-gathering bacteria in the soil.

Red clover.—A plot of 1½ acres was seeded to red clover in the spring of 1903. Wherever the ground was not too wet the seed was harrowed in. A fair stand was secured on the drier part of the plot, but it became poorer each year until by the season of 1906 the clover had entirely disappeared. A small plot was tested on plowed ground with similar results.

Alsike clover.—Two acres were seeded to alsike clover in the spring and fall of 1903, the rate of sowing being 15 pounds to the acre. An excellent stand was secured from the spring sowing. Up to the season of 1905 it still remained alive, but had made very little growth and seemed to be inferior to the native clover. It had a yellow and unhealthy appearance and showed an entire lack of the root tubercles. By the year 1906 about three-fourths of the clover on this plot had disappeared. The remaining fourth of the plants had made a much larger growth and showed a much healthier condition than in previous years. In 1907 it had entirely disappeared. It is quite possible that if the seed had been inoculated this clover might have proved a success.

Vetches.—A number of vetches were experimented with, most of them being tested on plowed ground. They all failed to germinate.

EXPERIMENTS OF BABCOCK & BENSON.

In addition to the experiments already described, in the latter half of October, 1902, Babcock & Benson scattered 1,000 pounds of timothy seed, 400 pounds of orchard grass, 150 pounds of Kentucky bluegrass, and 100 pounds of white clover over the section and the park-like areas of their 14-section beef pasture adjoining it. At first there were very few signs of this seed having germinated, but by the year 1904 it was quite noticeable that a good deal of the timothy and some of the orchard grass had caught and that they were doing well. The timothy became more abundant each year until by the summer of 1907 it was pretty well distributed over the entire section. There are at the present time numerous spots a rod or more square where the stand is sufficiently thick to cut for hay.

The orchard grass has made a fair showing, but hardly sufficient to repay the cost of the seed. The Kentucky bluegrass and the white clover were complete failures.

EXPERIMENTS ON THE COOKE & BULL CATTLE RANGE.

The experiments on the Cooke & Bull cattle range were undertaken in order to test the adaptability at a lower altitude of some of the grasses that had been tried at the Wenache Mountain station. The place selected is in a holding pasture at an elevation of approximately 4,000 feet. It is located some 6 miles southeast of the

Wenache Mountain station. The sowing was done in small meadow-like areas at the head of a large canyon, where for the most part there was a good loamy soil, and in the bottom and along the sides of the canyon. The entire region in which this tract lies has been badly overgrazed for years by numerous bands of migratory sheep on their journeys to and from the mountain pastures. As a result, practically the whole area where the seed was sown had been denuded of all vegetation except shrubs and trees. The principal grasses experimented with were timothy, redtop, and white clover.

Timothy.—Timothy was sown on approximately two acres in a meadow-like area at the head of Perkins Creek canyon in the fall of 1904. The seed was broadcasted at the rate of about 8 pounds to the acre without further treatment. The following fall about 50 pounds of this seed were scattered along the bottom and sides of the two forks of Perkins Creek canyon, near the head. In spite of the fact that a large number of cattle have been kept on this pasture at various times and that it has been closely grazed, the timothy in the original plot has retained an excellent stand. If it could be protected, this plot would yield a good crop of hay. There is also a good stand of this grass along the bottom of the canyon and it promises to make an excellent growth.

Redtop.—A small plot was seeded to redtop near a spring just below the forks of the canyon in the autumn of 1904. The following fall (1905) about 50 pounds of this seed were scattered along both forks of the canyon, approximately the same area being used as for timothy.

By the spring of 1907 the redtop in the plot looked highly promising. Where the seed had been scattered along the canyon there was considerable of this grass to be seen. By the season of 1908 it will be sufficiently established, judging by the small plot, to produce a considerable quantity of feed.

White clover.—A considerable area in the main branch of the canyon was seeded to white clover in the fall of 1904 and again in 1905. There is an excellent stand, and in spite of its having been heavily grazed the clover has been making a good growth. It is somewhat questionable whether white clover produces enough forage under such conditions to make it of much value.

Other grasses.—In addition to the grasses mentioned, perennial rye-grass, Italian rye-grass, and Kentucky bluegrass were tested under similar conditions. These have yielded negative results.

RESULTS OF RESEEDING INVESTIGATIONS.

The experiments of the Bureau of Plant Industry show quite conclusively that the depleted mountain meadows (Pl. I, figs. 1 and 2) can be brought back to their original carrying capacity in two to three years' time by reseeding with tame grasses. (See Pl. II, fig. 2, and Pl. III, figs. 1 and 2.) There are numerous instances, notably in the Cascade Mountains of Washington, where by the introduction of such grasses the meadows can be made to produce more forage than they ever did.

Out of the thirty or more grasses and forage plants tested, there are seven—tall fescue, orchard grass, brome-grass, mountain brome-grass, slender wheat-grass, timothy, and redtop—that have shown themselves to be of some importance in the restoration of mountain grazing areas. Timothy and redtop have proved to be of great value for this purpose. These two grasses can be introduced at a comparatively small cost, will furnish satisfactory yields, and will readily withstand moderately heavy grazing.

In addition to carrying on the experiments here described the writer has spent considerable time in studying the forage problems in the Cascade and Sierra Nevada Mountains and in making careful observations as to what has been accomplished by various stockmen and farmers in reseeding mountain meadows in that region. Several of these men have greatly increased the quantity of forage produced in such meadows by seeding them down to either timothy or redtop or a combination of the two. There are also a number of instances where these men are raising good crops of hay with which to supply the various lumber, mining, or tourist camps. Other investigations carried on by members of the staff of the Bureau of Plant Industry show that these grasses can readily be established throughout the Rocky Mountain system. In fact, they are quite widely scattered through the hauling of hay to the various mining and lumber camps and also through systematic effort on the part of some of the stockmen living in that region.[a] The results obtained by these various stockmen show that there are numerous meadows throughout the entire western mountain region where timothy and redtop can be very successfully grown. They also prove that it is a paying proposition to seed down such meadows.

TIMOTHY.

Timothy will be of great value in restoring those areas where there is a fairly deep, rich soil that has been denuded of vegetation by overgrazing and trampling. Plate I, figures 1 and 2, shows portions of two different mountain meadows that are typical of just such results. This grass can also be used to advantage in those places where the mountain clovers naturally grow. (See Pl. IV, figs. 1 and 2.)

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[a] See Bulletin No. 117 of the Bureau of Plant Industry, U. S. Department of Agriculture, p. 11.

An example of what can be accomplished by the use of this grass is shown in Plate II. Figure 1 of this plate shows a part of a meadow near the Wenache Mountain station, lying just outside of the station fence. This area has been protected from overgrazing during the past five years, and as a result it is restored to a point where it will probably carry nearly as much stock as it originally did. Plate II, figure 2, shows a part of the same meadow lying just within the fence. This area was seeded to timothy in the autumn of 1902. The carrying capacity of the area seeded down is undoubtedly two or three times greater than that not seeded.

It is recommended that from 8 to 10 pounds of seed be used to the acre. This will give a stand that will be good enough to cut for hay. (See Pl. II, fig. 2.) If it were necessary to economize, a rate of 6 pounds per acre might prove sufficient, but the stand secured would, of course, not be as good as where a little higher rate of seeding was used. Although stands that have been entirely satisfactory have been obtained in places that have been subjected to continuous grazing, better results will usually be obtained if the seeded area can be protected during the first season or at least until the grass has become firmly rooted.

If the maximum rate of 10 pounds to the acre be used, the seed at 6½ cents a pound will cost 65 cents. The labor, provisions, and cost of hauling will bring the entire expense to about 95 cents an acre. The plots at the Wenache Mountain station have given a yield that if cut for hay would have averaged more than a ton to the acre. While the experiments have been carried on under practically typical range conditions it is possible that they have been a little better protected than they would have been in a large inclosure. Granting that these results are better than will be obtained under all circumstances, it is reasonable to believe that in an ordinary mountain meadow where there is a fairly deep and good soil a yield equivalent to at least half a ton of hay to the acre can be secured. Observations of the results obtained by practical stockmen will tend to confirm this conclusion. If the yield is equivalent to only half a ton it will still mean that the carrying capacity of this land has been increased so that an acre will carry a 1,200-pound steer a little more than 30 days longer than it previously did. If we value pasture at 25 cents a head each month this would, after the first year, give a return of more than 25 per cent on the cost of seeding.

In this connection an estimate has been made in order to show what can be accomplished by reseeding a pasture that is within some 5 or 6 miles of one of the above-mentioned experiment stations. This pasture has been carefully watched during the entire four years and it is doubtful if its carrying capacity is as high as it was previous to fencing. The field contains approximately 1,100 acres and carries about 100 head of stock of all ages during the five summer months. It is a typical mountain pasture, the ridges consisting largely of "scab" land—land where there is very little soil—and the hillsides and bottoms of the canyons having a good, deep, rich soil. There are at least 300 acres of this pasture that could be seeded to timothy to good advantage. Using the same figures, the cost of seeding this area would be as follows:

3,000 pounds of seed at 6½ cents a pound	$195
Labor at $1.50 a day	45
Provisions	15
Cost of hauling seed, provisions, etc	20
Total	275

If we estimate, as above, that a stand sufficient to yield half a ton of hay to the acre is secured, the pasture by the second summer after seeding will be in position to support 60 additional head of cattle, or nearly two-thirds more than at present, through the grazing season of five months.

Considering pasturage worth 25 cents per month per head, this pasture will be in a position to yield a return of more than 25 per cent a year on the expense of seeding it down.

As a result of these investigations two stockmen who have extensive holdings in the mountain grazing areas have sown timothy in their mountain meadows. These men are much pleased with the results obtained and consider that the grazing capacity of their meadows has been sufficiently increased to make reseeding a very paying investment.

REDTOP.

Redtop will also be of value in the improvement of mountain meadows. It can be used to advantage under the conditions shown in Plate I, figures 1 and 2, but will be most useful in reseeding those places that are too wet for timothy. It will do well on those areas where timothy grows successfully, and in the Sierra Nevada Mountains of California will apparently make a very good growth where it is a little too dry for timothy.

The most serious objection to this grass is that it is very slow in getting started, especially in the high altitudes. (See Pl. III, fig. 1.) It will be necessary to wait at least three years before redtop will make much of a showing. Once established it is there to stay. These investigations have shown that not only will this grass remain permanently, but it will gradually become thicker in that part of the meadow in which it is sown and will in time spread through the meadow, eventually crowding out much of the native vegetation.

From 10 to 15 pounds of seed of the very best quality should be used to the acre. If the seed is full of chaff this rate should be doubled.

Although no experiments in mixing this grass with timothy have been made, it is reasonable to believe that such a mixture might prove valuable. The timothy would be available for pasturage the second summer after seeding and for a number of years thereafter. The redtop would not be well enough established to yield any returns before the third or fourth year. Once started it would continue to become more abundant and would remain permanently even though the timothy might run out.

TALL FESCUE.

Were it not for the fact that the seed of this grass is very expensive and that timothy can be established at a much less cost, tall fescue would in all probability play an important part in range improvement. It gives good yields, stands grazing well, and is a favorite with stock, as they prefer it to either timothy or redtop. Of all the grasses tried at the Wenache Mountain station it has proved third best. This grass should be sown at the rate of 25 pounds to the acre, and if not too expensive it would be advantageous to harrow it in.

ORCHARD GRASS.

The investigations made in California indicate that orchard grass can probably be used to advantage in improving the mountain grazing areas of that State. In Washington this grass has made a very good growth, but it has been very difficult to get a good stand of it.

Orchard grass will be of most value on those areas that are a little too dry for the successful growth of timothy, such as the outside edges of mountain meadows. (See Pl. IV, fig. 1.) As there seems to be considerable difficulty in getting a stand, a heavy rate of seeding, not less than 25 pounds to the acre, should be used. If possible, the seed should be harrowed in.

BROME-GRASS.

Like tall fescue, brome-grass has shown itself worthy of consideration in reseeding mountain meadows. It has given a good stand and made an excellent growth. Of all the grasses tested it has been the favorite with the stock pastured on the section, and as a consequence has at times been very heavily grazed. It has readily withstood the occasional overgrazings and the stand has improved each year.

At the present price of the seed (about 11 cents a pound) it is doubtful from a range standpoint whether it can be used profitably. Not only is the seed expensive, but good results require that it be harrowed in. Although its cost makes it prohibitive for use alone, it might be a good plan to sow a little of the seed along with timothy. Once established, the brome-grass would have a tendency to thicken and would probably be permanent.

MOUNTAIN BROME-GRASS.

This grass is a native of the mountains of the Western States. It formerly grew quite abundantly on the gravelly hillside areas of these mountains, but has been largely exterminated through overpasturing. The experiments at the Wenache Mountain station show that it can easily be reseeded and that an excellent stand can be secured. Investigations made in the Warner Mountains of California confirm this conclusion. As the seed is large and heavy it should be sown at the rate of 25 pounds to the acre. While mountain brome-grass can be reintroduced by merely reseeding the ground, the best results will be obtained if the seed is harrowed in. Next to timothy this grass has made the best growth of any of those included in the experiments here recorded. From the standpoint of yield and as a grass to cover the denuded side-hill areas, it will prove entirely satisfactory. (See Pl. III, fig. 2.) Its chief drawback lies in the fact that stock will not eat mountain brome-grass readily when they can find more palatable feed. The plot at the Wenache Mountain station has been grazed but very little. It has, however, been located near others bearing grasses that are naturally favorites with stock. In contrast to this it is noticeable that whenever this grass occurs on the open range or in places where there is not an overabundance of feed, it is readily eaten.

SLENDER WHEAT-GRASS.

As the experiments tried at the Wenache Mountain station with slender wheat-grass were not begun in the fall of 1904, the plots are not old enough to draw definite conclusions. There are, however, strong indications that this grass will prove of considerable value in reseeding gravelly hillside areas.

Extensive experiments are now being carried on with this grass in the Warner Mountains of California to determine the practicability of using it in the restoration of the overgrazed gravelly areas of the mountain sides at high altitudes. These experiments are under the direct charge of Mr. A. H. Hogue, supervisor of the Warner Mountain National Forest. If they succeed this grass will be of great value in the improvement of such areas, as it is greatly superior to mountain brome-grass, being much more palatable to stock and also more nutritious.

CLOVERS.

At the present time the clovers can not be recommended in improving mountain meadows. In all the experiments at the Wenache Mountain station they have been complete failures. During the first two years of its existence the alsike clover gave an excellent stand. It made a very poor growth, however, and finally died out.

The white clover tried at the Wenache Mountain station both in the plots and by Babcock & Benson proved a failure. On the Cooke & Bull range, which is from 1,000 to 1,500 feet lower, the very same seed has given a fairly good stand, but it has not as yet made a very large growth.

METHODS OF RESEEDING.

In this work the writer has obtained the best results by using a hand seeder such as is commonly used in seeding alfalfa. With such a machine a man can easily sow from 10 to 12 acres a day. This acreage can be greatly increased, especially in scattered areas, if a saddle horse is used and the sowing is done on horseback.

If the seeding is done in wet meadows, where there is more or less standing water, it will probably be best to wait until late spring or early summer when the ground and soil water are so warm that the seed will germinate. The grass will then become sufficiently established to withstand the coming winter. In sowing timothy and redtop, except on very wet areas, the best results will be obtained if the ground is seeded late in the fall just before the snow falls. At that time there will be no danger of the seed sprouting and being killed by cold weather. The following spring the melting snows will tend to carry the seed below the loose, mulchy soil to the moist compact soil beneath. Continued observation has shown that this loose, mulchy soil becomes too dry on top for the germination of seed almost as soon as the snow is gone and within a very few hours after a shower. It is therefore essential that the seed be gotten under the mulch by some such means as the melting of snow, a heavy shower, or harrowing. These grasses can be seeded in the spring, but unless there are very favorable rains it will be necessary that the seed be harrowed in, if the work is to be successful. Where the seed is rather large, as is the case with brome-grass, orchard grass, and slender wheat-grass, it is probable that the extra stand secured will justify the extra cost of harrowing.

Plowing and a thorough preparation of the soil are advocated by some. If the cost of getting the plow into the high mountains and of operating it there be taken into consideration, this method will ordinarily be found impracticable. The results obtained at the Wenache Mountain station show that, with the exception of slender wheat-grass and orchard grass, the stands secured on plowed ground have been very little, if any, better than where the seed was merely harrowed in. Not only is plowing unnecessary, but under some circumstances it would be positively injurious. There are numerous mountain meadows which are practically surrounded by hills that have been denuded of vegetation by overgrazing. To plow such a meadow would be a very dangerous proceeding. The instant the soil is loosened the first rush of water from these hills after a heavy rain or a spring freshet will carry all the soil away and completely ruin the meadow.

OTHER IMPROVEMENTS.

While reseeding is the main factor in the improvement of mountain meadows there are three other means that under some circumstances can be used to advantage and will be of considerable importance in making the reseeding pay. These are (1) the drainage of meadows that are too wet, (2) the filling in of old washouts, and (3) irrigation.

DRAINAGE.

Many mountain meadows, especially in high altitudes, are too wet for the growth of suitable forage. The prevailing vegetation consists of sedges, rushes, and other water-loving plants. The quality of this feed is very poor. If these meadows can be properly drained the native vegetation growing on the drier areas, which usually has a much higher forage value, will gradually work into the drained areas and supplant the original vegetation. This will bring about a very great improvement in the quality of feed produced. After the meadows have been drained it is recommended that they be seeded down to either timothy or redtop, especially if they have been subjected to overgrazing in the past. The combined drainage and seeding will result in greatly increasing the carrying capacity of the meadows. Not only will there be more forage, but it will be of much better quality.

This method of improvement must be used with a great deal of care, for if the draining is not properly done it may result in the destruction of the meadow. Pains should be taken to see that the drains are not cut too deep and that there is no danger from future washouts. If such a meadow is surrounded by steep hills that have been denuded of vegetation so that there is danger of a sudden rush of water, it will be much safer to leave it undrained.

FILLING IN WASHOUTS.

A large number of mountain meadows are not producing nearly the quantity of feed they formerly did. Ordinarily this is because the meadows and the surrounding hills have been too severely overgrazed in years gone by. As a result the water from the melting snows or from rains goes out with a rush and the little creeks that run through these meadows have cut deep channels. Plate IV, figure 2, shows such a cut in the process of formation. These cuts serve as drains, but being too deep draw off the ground water too far beneath the roots of the vegetation. This results in the death of the vegetation or in greatly lowering its rate of growth. It also enables many drought-resistant weeds that are of little forage value to get a foothold and crowd out the original vegetation.

Some of these meadows could be restored to their former carrying capacity by throwing dead logs, brush, and other rubbish into the creeks at intervals. This rubbish will tend to catch the silt that washes down, and thus gradually fill up the cuts that have been formed. This has been very successfully done in the mountains of California in one or two instances that have come under the writer's notice.

IRRIGATION.

There are a number of mountain meadows where the quantity of forage produced (Pl. IV, fig. 1) can be greatly increased if the water from the streams running through them can be diverted and allowed to spread over the land. A number of instances have been noticed where stockmen have plowed a furrow along the outer and higher edges of a meadow or along the side hill just above it and have diverted the water from the creeks to these furrows with excellent results. The increase in the forage produced where the water from these furrows has been allowed to seep through the ground has in some instances been quite striking. It would ordinarily require only a small outlay of work to make these furrows. As it is usually necessary to keep a herder or fence rider to look after the stock, it will take very little extra time on his part to see that the water is properly diverted to such furrows.

CONCLUSIONS.

(1) The experiments and investigations carried on during the past five years by the Bureau of Plant Industry show that the carrying capacity of mountain meadows can be greatly increased by reseeding with tame grasses.

(2) The grasses best adapted to this purpose are timothy and red top. This is because they can be sown the most economically and will give the best returns.

(3) The introduction of timothy into a devastated mountain meadow will mean that the carrying capacity of such a meadow will be increased so that an acre will carry a 1,200-pound steer at least one month longer than it did previously. Ordinarily it will carry him two months longer.

(4) Timothy can be introduced at a cost of 95 cents per acre. If pasturage is worth 25 cents a month for each head of stock, it is reasonable to expect a return of more than 25 per cent on the cost of reseeding.

(5) Redtop will be of most value in reseeding those places that are too wet for timothy.

(6) A mixture of timothy and redtop will probably prove valuable. Timothy will give returns quickly, while redtop is more permanent and has a tendency to spread.

(7) Brome-grass, tall fescue, and orchard grass have proved to be well adapted to mountain-meadow conditions, but the cost of their introduction will prohibit their extensive use.

(8) Mountain brome-grass will readily recover the gravelly hillside areas that have been denuded by overgrazing. Where there is an abundance of succulent feed this grass is not readily grazed by stock.

(9) Slender wheat-grass may eventually prove of more value on the mountain slopes. Experiments to determine this point have not been continued sufficiently long to permit definite conclusions to be drawn.

(10) Timothy and redtop should be sown in the late autumn in order to save the expense of harrowing.

(11) Where the seed is large, as in the case of brome-grass, mountain brome-grass, etc., harrowing is strongly recommended.

(12) Plowing is ordinarily impracticable and sometimes positively injurious.

(13) Drainage, partial irrigation, and the filling in of old washouts will sometimes aid in the improvement of native meadows.

PLATES.

DESCRIPTION OF PLATES.

Plate I. Mountain meadows in the Warner Mountains, California, where timothy can be sown to excellent advantage. Fig. 1.—A typical moist mountain meadow where all vegetation has been destroyed and a species of Veratrum has taken its place. This is an ideal place for seeding with timothy and redtop. Fig. 2.—The edge of a badly overgrazed mountain meadow where timothy should be sown. Reseeding would greatly increase the carrying capacity of this meadow.

Plate II. Results of reseeding. Fig. 1.—A portion of a mountain meadow allowed to restore itself through protection from overgrazing. Fig. 2.—A portion of the same meadow (just inside fence) where timothy was sown in 1902. It has been closely grazed each fall since.

Plate III. Plots at the Wenache Mountain station. Fig. 1.—Meadow seeded with redtop four years previously. The dark streaks in the picture are the young redtop heads. Fig. 2.—Meadow seeded with mountain brome-grass (*Bromus marginatus*). The boundary line of the plot is plainly shown in the foreground.

Plate IV. Mountain meadow where the carrying capacity has been lowered by a stream cutting a deep channel, thus draining the meadow too much. Fig. 1.—General view of the meadow. Fig. 2.—The same meadow illustrated in figure 1, showing the early stages of erosion.

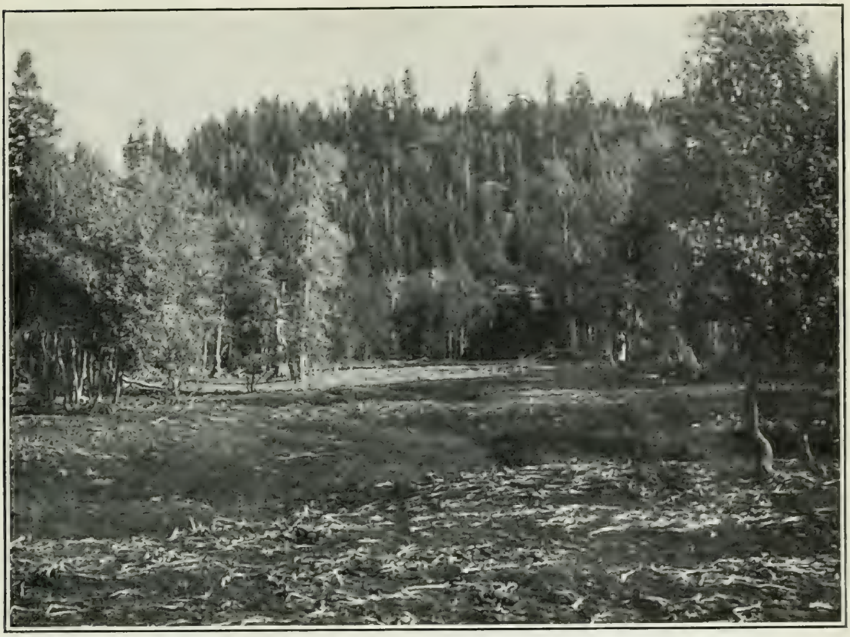

FIG. 1.—A TYPICAL MOIST MOUNTAIN MEADOW WHERE THE ORIGINAL VEGETATION HAS BEEN DESTROYED.

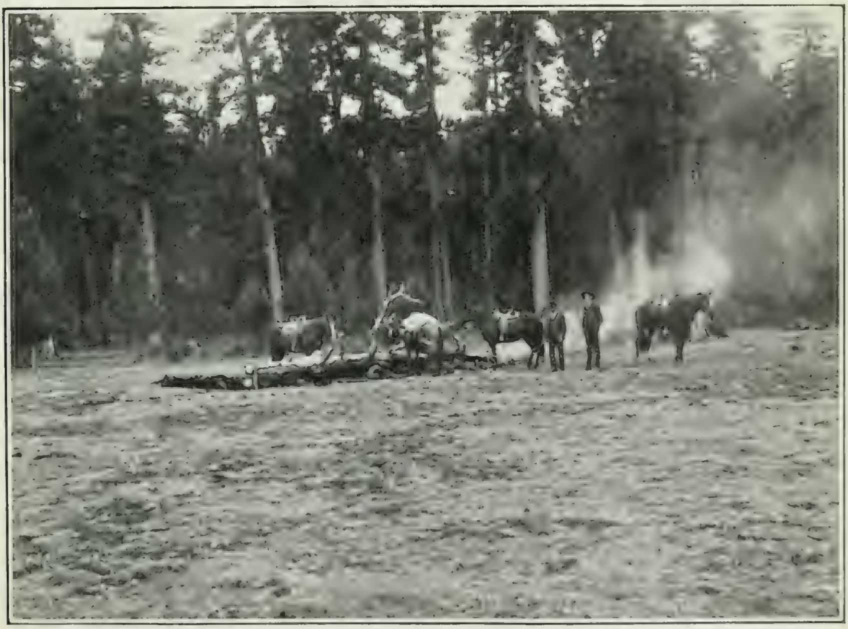

FIG. 2.—THE EDGE OF AN OVERGRAZED MEADOW WHERE TIMOTHY AND REDTOP SHOULD BE SOWN.

MOUNTAIN MEADOWS THAT SHOULD BE RESEEDED.

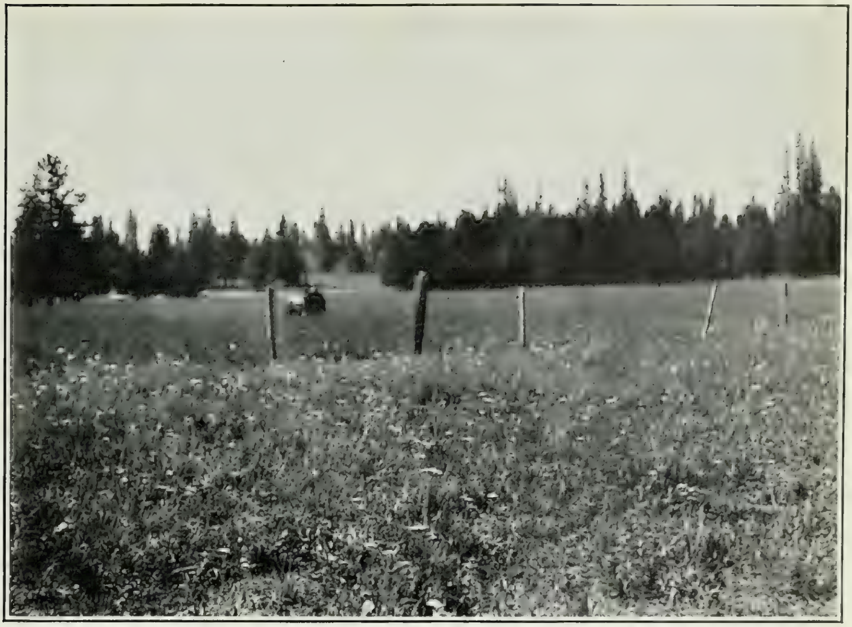

FIG. 1.—A PORTION OF A MOUNTAIN MEADOW RESTORED THROUGH PROTECTION.

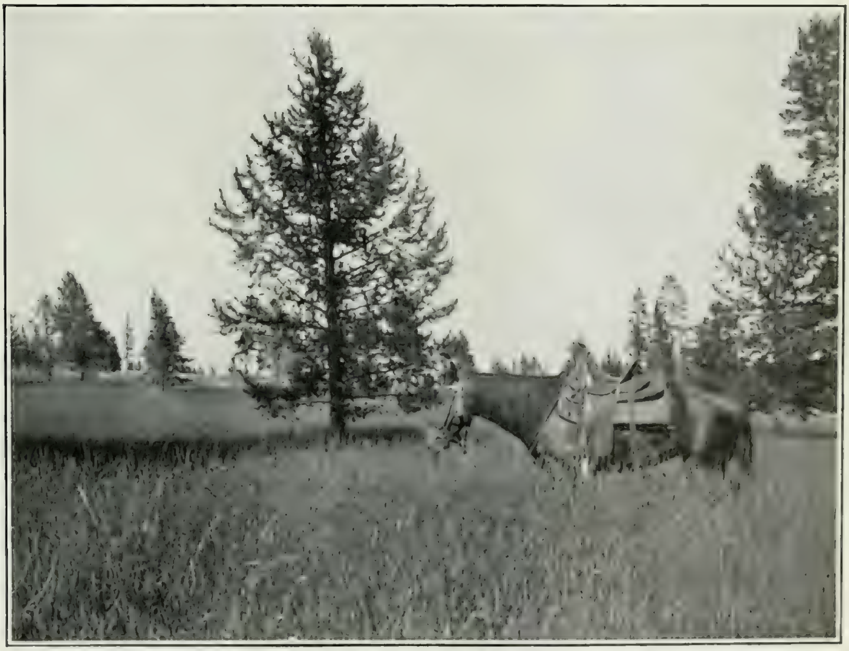

FIG. 2.—A PORTION OF THE SAME MEADOW SEEDED TO TIMOTHY.

RESULTS OF RESEEDING.

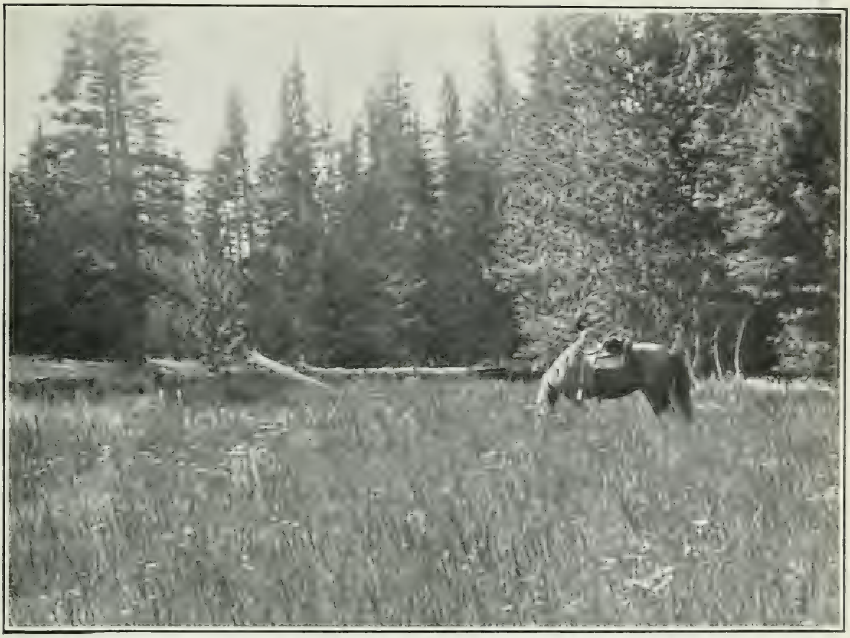

FIG. 1.—MEADOW SEEDED WITH REDTOP FOUR YEARS PREVIOUSLY.

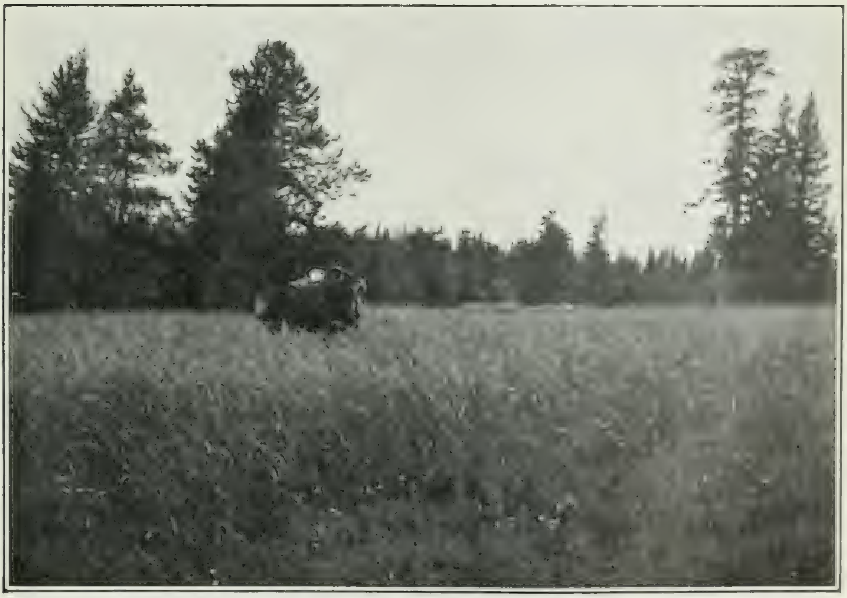

FIG. 2.—MEADOW SEEDED WITH MOUNTAIN BROME-GRASS.

PLOTS AT THE WENACHE MOUNTAIN STATION.

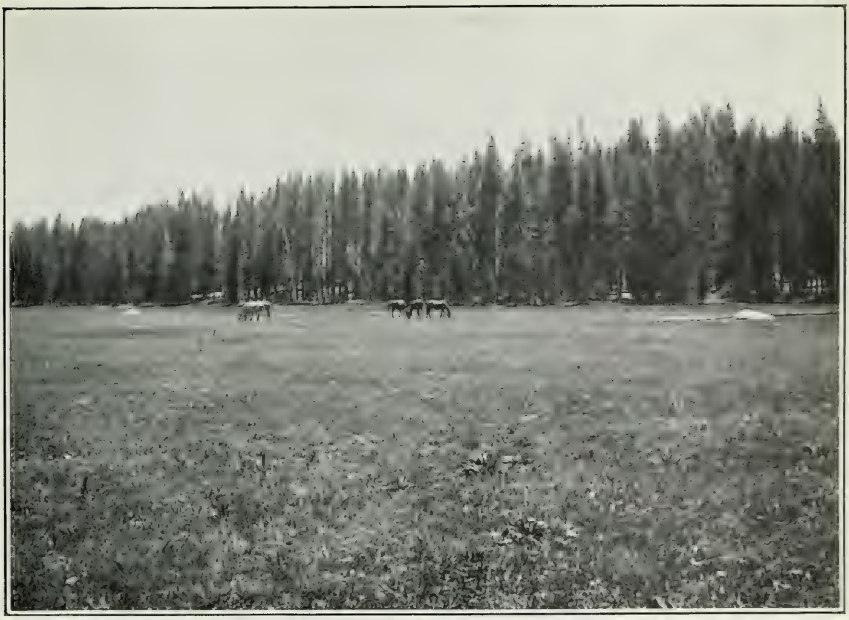

Fig. 1.—General View of the Meadow.

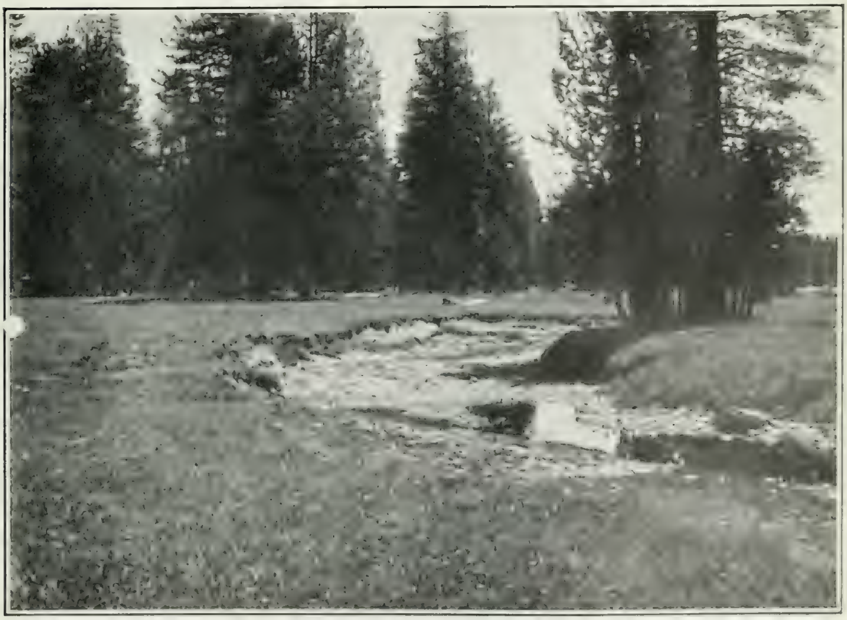

Fig. 2.—The Same Meadow, Showing Early Stages of Erosion.

MOUNTAIN MEADOW INJURED BY EROSION.

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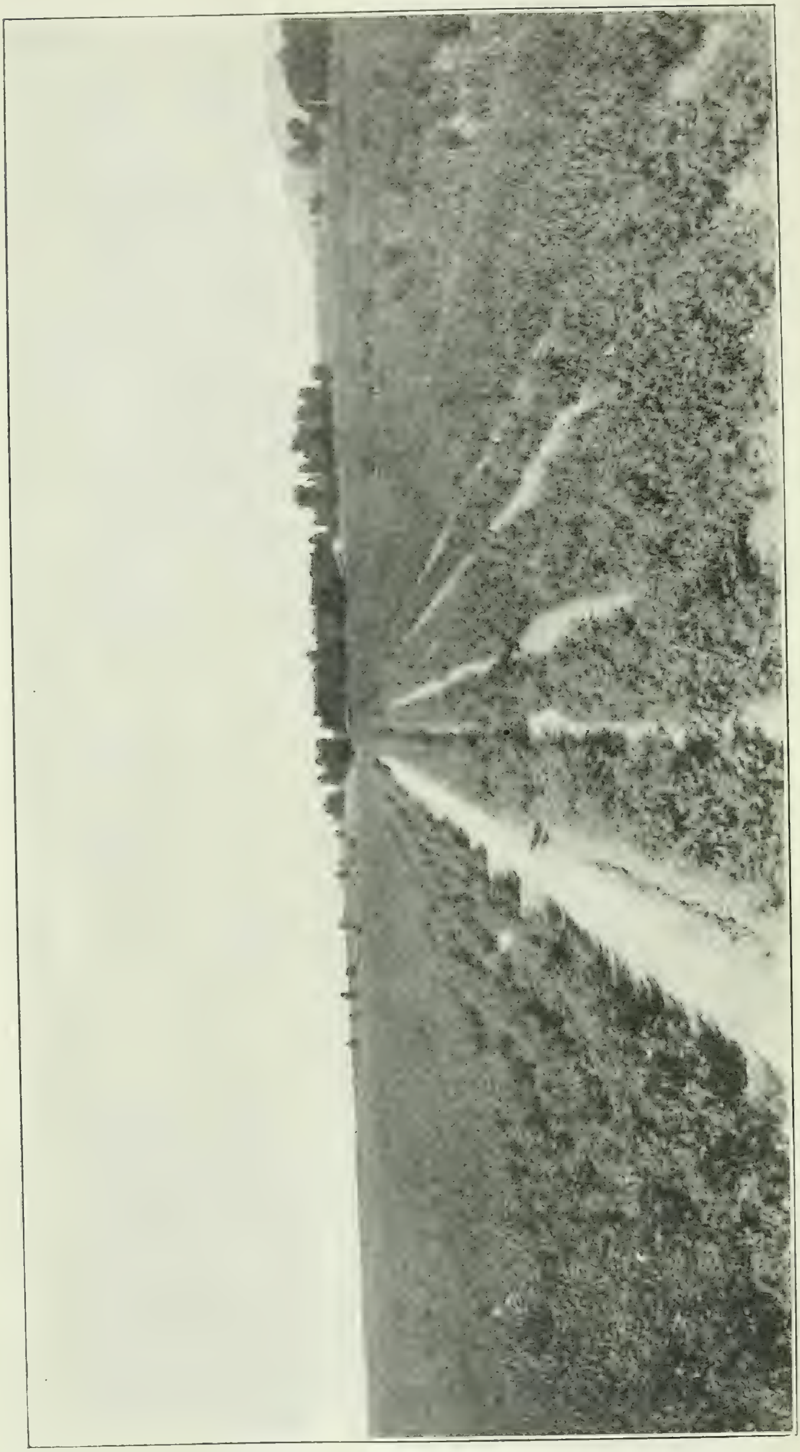

EXPERIMENTAL COTTON FIELD AT YUMA, ARIZ., IN 1907.

U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 128.

B. T. GALLOWAY, *Chief of Bureau.*

EGYPTIAN COTTON IN THE SOUTHWESTERN UNITED STATES.

BY

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Physiologist in Charge of Alkali and Drought Resistant
Plant Breeding Investigations.

AND

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Extension Investigations.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., March 25, 1908.

Sir: I have the honor to transmit herewith and to recommend for publication as Bulletin No. 128 of the series of this Bureau the accompanying manuscript, entitled "Egyptian Cotton in the Southwestern United States," by Thomas H. Kearney, Physiologist in Charge of Alkali and Drought Resistant Plant Breeding Investigations, and William A. Peterson, Farm Superintendent, Western Agricultural Extension Investigations.

This bulletin calls attention to the fact that we now import from Egypt an average of sixty million pounds of cotton annually, notwithstanding the fact that this country far surpasses all others in its exports of this staple. The Bureau of Plant Industry has experimented for several years past with a view to establishing Egyptian cotton culture in some portion of the United States. In the main cotton belt the results on the whole have not been encouraging, but in the irrigated districts of the extreme Southwest, notably in southern Arizona and southeastern California, much progress has been made in acclimatizing two of the leading varieties and improving them by selection.

The climatic and soil conditions of the Colorado River region are admirably adapted to cotton growing and considerable interest in this crop has recently been manifested there. Owing, however, to the distance from manufacturing centers and the high price of labor which prevails, it is believed that a profitable cotton industry can be developed in that region only by associating it with some special type of cotton bringing a higher price than Middling Upland and not grown elsewhere in the United States. Egyptian cotton fully meets these requirements.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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EGYPTIAN COTTON IN THE SOUTHWESTERN UNITED STATES.

INTRODUCTION.

Although the United States is by far the greatest cotton-producing country in the world, a large quantity of this staple is every year imported from Egypt. During the past ten years the direct imports from Egypt have averaged nearly fifty-four million pounds, besides an average annual importation from Great Britain of eight and one-half million pounds, the great bulk of which was undoubtedly produced in Egypt. In 1907 the value of the direct imports from Egypt exceeded all records, amounting to over $16,000,000. The average price of this cotton on the Boston market in 1907 was 21.9 cents per pound.

Several varieties of cotton are grown in Egypt, but all of them are of one well-marked type that resembles in many respects the American Sea Island. They are characterized by long and very strong fiber, smooth seeds, small, pointed, three-locked bolls, and yellow flowers. Some of them, notably the Abbasi and Jannovitch varieties, are second only to Sea Island cottons in the length, fineness, and silkiness of their fiber. The first is pure white, the latter of a very light cream color. The most extensively grown variety, Mit Afifi, has a soft, rather crinkly fiber of a characteristic light brown color that renders it especially useful for certain classes of cotton goods in which the natural color of the fiber is retained. The great strength and high degree of twist allow the production of a very strong yarn. The best Egyptian cottons bring a price second only to that paid for the highest grades of Sea Island, being used solely in the manufacture of the finest goods. They are especially suitable for mercerizing, taking this process better than either Sea Island or Upland cottons, and are largely used for mixing with silk and for the manufacture of cloths in which a high finish and luster are required.

In view of the considerable value of this import, the Department of Agriculture is endeavoring to develop Egyptian cotton culture in the United States in order to supply our own market with a home-grown product. The Office of Seed and Plant Introduction has several times imported seed of the standard Egyptian varieties and these have been tested at many localities throughout the main cotton belt from South Carolina to Texas, as well as in extreme western Texas, New Mexico, Arizona, and southeastern California.

In the humid part of the United States, where cotton is already the principal crop, the Egyptian types have given only indifferent success, although the quality of the fiber produced has in many cases been excellent. The chief drawback has been their late ripening, and hence the failure to obtain full yields.

Success in this effort can be looked for in the Southwest, and especially in the Colorado River region, where the very long, hot, almost rainless summers, deep alluvial soils, and irrigated agriculture approximate the conditions obtaining in Egypt. The length of the season in southern Arizona and southeastern California permits many more bolls to ripen on plants of the Egyptian varieties and hence larger yields than anywhere in the cotton belt proper.

That success could be expected in the Southwest had already been indicated by the results obtained at Phoenix, Ariz., in 1900 and 1901 by the Territorial Experiment Station. In 1902 the Bureau of Plant Industry commenced experiments with Egyptian varieties at Barstow, Tex., and Carlsbad, N. Mex. (both localities in the Pecos Valley), and at Yuma, Ariz., and Calexico, Cal., the latter two localities being in the Colorado River region. For various reasons the work was finally concentrated at Yuma.

During the first three years the results were far from encouraging, so far at least as the Mit Afifi variety is concerned. The plants made an exceedingly rank growth, were relatively sterile, the bolls opened very late and imperfectly, and the fiber was relatively short and coarse. After five years of acclimatization and selection, however, there has been a very great improvement in all these respects. In 1907 Mit Afifi cotton yielded at Yuma at the rate of 990 pounds of fiber to the acre, a yield practically equal to that of the most productive Upland variety that was grown in the same field. The fiber averaged nearly 1½ inches long, was exceedingly strong, and possessed the delicate brown color that is so desirable in this type. The bolls, although much smaller than those of Upland varieties, opened perfectly. It was found that the cost of picking was only about one and one-half times as much for Egyptian cotton as for such large-bolled Upland varieties as Triumph and Rogers Big Boll.

In view of these results, the possibility of establishing Egyptian cotton culture on a commercial scale in the irrigated valleys of the Southwest deserves serious consideration. The remoteness from existing markets and the scarcity and cost of labor make it very doubtful whether short-staple Upland varieties can be profitably grown in that part of the country unless the unusually high prices of the last few years are maintained. On the other hand, the more valuable long-staple Upland or "Peeler" varieties have not yet yielded at Yuma as heavily as the acclimatized Egyptians. The best prospect of building up a permanently remunerative cotton industry in the Southwest undoubtedly lies in identifying that region with the production of a special type of high-grade cotton, one that is grown in no other part of the United States and is demanded by a special market willing to pay high prices for a first-class product. All these requirements are met by Egyptian cotton and by no other.

The climatic conditions of the Colorado River region in southern Arizona and southeastern California are unrivaled from the standpoint of cotton growing. At least 600,000 acres of excellent land are or soon will be under ditch in the Imperial, Yuma, Salt, and Gila valleys. One-fifth of this acreage could produce the average amount of Egyptian cotton that is annually imported into the United States. The soils are for the most part very fertile and an abundant and permanent supply of water for irrigation is at hand. It has been demonstrated that yields of one to two bales per acre are possible in this region and the fiber produced has been pronounced by experts as equal to the better grades imported from Egypt.

Two principal difficulties remain to be overcome: Labor and marketing. Since cotton must be picked by hand, the first is a serious difficulty in a region where labor is so scarce and high priced. The problem of transportation also remains to be solved. But, in view of the high price brought by this cotton, there is good reason to believe that it will be found feasible to ship it by rail to Pacific coast or even to Gulf ports, and thence by water to the New England cities where it is manufactured. So long as these problems remain unsolved, however, farmers who are contemplating growing cotton in the Southwest are cautioned to look carefully into the possibilities of picking and marketing their crop before planting any considerable acreage.

Since there is every indication that Egyptian varieties offer the best prospect of building up a profitable and lasting cotton industry in the irrigated valleys of the Southwest, planters in that region are urged to consider the question carefully before committing themselves to growing Upland varieties. The introduction of the latter would seriously interfere with keeping the Egyptian varieties up to the high standard which has been attained, since a certain amount of crossing would inevitably take place. Moreover, Indians and other pickers, should they become accustomed to the large-bolled Upland varieties, would be more reluctant to pick the small Egyptian bolls than if they were familiar only with the latter. Finally, there would be danger of introducing with the seed of Upland varieties some of the diseases and insect enemies that ravage this crop in the Southern States, but have not yet appeared in the isolated valleys of the Southwest.

The introduction of the cotton boll weevil would be ruinous to the industry at the very outset. Immunity from this destructive insect can be insured only by a rigorous inspection of all cotton seed introduced from the weevil-infested district, which now includes practically the whole of Texas, as well as parts of Louisiana, Mississippi, Arkansas, and Oklahoma. The safest plan would be to admit no seed from other cotton-growing districts that has not been thoroughly fumigated.[a]

Those who contemplate experimenting with Egyptian varieties of cotton should avoid the use of directly imported seed, which is likely to give disappointing results during the first two or three years it is grown in the United States and hence to prejudice the grower against this type of cotton. Thoroughly acclimatized seed is under all circumstances to be preferred.

Since cotton growing under irrigation in an arid climate is still in the experimental stage in the United States, it has been deemed advisable to begin this paper with a brief description of the physical conditions prevailing, the varieties grown, and the cultural methods used in Egypt, where the crop is produced under irrigation with great success on a large scale. The portion of the United States that most resembles Egypt in its physical characteristics will then be taken up and the principal features of its climate, soils, and water supply will be pointed out. The results so far obtained in adapting Egyptian cottons to this area by acclimatization and breeding will next be discussed. Experiments in methods of growing the crop under irrigation are described and such recommendations as to cultural practices are given as the information now at hand will warrant.

COTTON CULTURE IN EGYPT.[b]

No country in the world is better adapted than Egypt to growing cotton. The long, hot, rainless summers, deep alluvial soils, plentiful supply of water for irrigation, abundance of cheap labor, facilities for economical transportation to the best markets, and, last but not least, the possession of distinct and very valuable types of cotton are a combination of conditions for the production of this staple that is well-nigh unrivaled. Hence it is that cotton can be grown at a profit in the Nile Delta on land that sells for from $300 to $800 an acre.

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[a] Farmers' Bulletin 209 gives full particulars regarding the fumigation of cotton seed.

[b] The following description is based partly on the results of an expedition to Egypt made for the Office of Seed and Plant Introduction in 1902 by Messrs. T. H. Kearney, of the Bureau of Plant Industry, and T. H. Means, formerly of the Bureau of Soils, now of the United States Reclamation Service, the primary object of which was to study the cotton industry of the country and the climatic and soil conditions under which it exists. Published accounts of Egyptian agriculture have also been freely consulted. In regard to the varieties grown and the cultural methods used, much information has been drawn from Mr. G. P. Foaden's Notes on Egyptian Agriculture, published as Bulletin 62 of the Bureau of Plant Industry, U. S. Department of Agriculture, 1904, to which the reader is referred for further details.

Agricultural Egypt consists of the long narrow valley and the broad fan-shaped delta of the River Nile. In the Nile Valley south of Cairo about 2,300,000 acres are in crops, while in the Delta, where nine-tenths of the cotton is produced, there are 3,400,000 acres of cultivated land. All of this land is under irrigation, the rainfall being wholly inadequate for crop production. An elaborate system of canals carries the water of the river to every part of the cultivated area. The recent completion of two great dams on the Nile in Upper Egypt, one for storage and the other for diversion, in addition to the diversion dam that has stood for many years at the point where the river forks, a few miles north of Cairo, insures a sufficient supply of water to irrigate practically this entire acreage, even in years when the river is lowest.

While other summer crops, such as rice, Indian corn, and, in southern Egypt, sugar cane and sorghum, are extensively grown, cotton is by far the most important money crop of the country and is in fact the backbone of Egyptian agriculture. It is estimated that this crop now occupies annually from one and one-half to one and three-fourths million acres. The fertility of the soil is in large part maintained by the almost universal practice of growing in winter leguminous forage crops, the most important of which is berseem, or Alexandrian clover.[a] Cotton is grown once every two or three years in rotations which include clover or beans and wheat or barley as winter crops and Indian corn as a late summer crop.

PHYSICAL CHARACTERISTICS OF THE COUNTRY.

CLIMATE.[b]

Egypt is essentially a great oasis in the midst of the most extensive body of extremely arid land in the world. West of the Nile and beginning almost at the river bank the Sahara stretches across northern Africa to the Atlantic Ocean. From the east bank of the river, interrupted only by the narrow Red Sea, the desert extends to northwestern India. Consequently, except in the district near the Mediterranean Sea, Egypt has an arid climate. In southern Egypt especially the air is very dry and the rainfall is exceedingly light, the annual average, even at Cairo, being only 1 inch. In the Delta region, which borders on the Mediterranean, the rainfall is greater, averaging 8.26 inches at Alexandria, on the coast. The mean relative humidity, especially in the months from March to August, is also considerably greater in that part of the country.

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[a] For a description of this plant and the important part it plays in Egyptian agriculture, see Bulletin No. 23 of the Bureau of Plant Industry, 1902; also Bulletin No. 62 of the same series, pp. 46–49.

[b] The meteorological data for Egyptian localities are taken from Capt. H. G. Lyons' "Physiography of the Nile River and Its Basin," Cairo, 1906, pp. 296 to 298 and 339 to 341. The length of the periods covered by the observations is not stated. The data for Phoenix and Yuma, Ariz., have been obtained from Prof. A. J. Henry's "Climatology of the United States," Bulletin Q, U. S. Weather Bureau, 1906, pp. 907 and 909. The observations of temperature and humidity at Phoenix cover a period of eight years. Those of temperature at Yuma cover a period of twenty-eight years and those of humidity one of fifteen years. It should be noted that the observations are taken at Phoenix at a height of 47 feet above the ground and at Yuma at a height of 16 feet (5 feet during the first ten years), a difference that should probably be taken into account in comparing the records from the two stations.

As regards temperature, Egypt possesses a subtropical climate, the greater part of the country being nearly frost-free. The winters are short and mild, the summers very long and hot. These are excellent conditions for the varieties of cotton grown in Egypt, which require an unusually long season in order to ripen their entire crop.

The following table affords a comparison of the temperatures of Egypt with those of the southwestern portion of the United States:

TABLE I.—*Mean monthly and annual temperatures, in degrees Fahrenheit, at localities in Egypt and in the southwestern United States.*[a]

Month.	Alexandria, Egypt.			Cairo, Egypt.			Phoenix, Ariz.			Yuma, Ariz.		
	Mean.	Mean of maximum.	Mean of minimum.	Mean.	Mean of maximum.	Mean of minimum.	Mean.	Mean of maximum.	Mean of minimum.	Mean.	Mean of maximum.	Mean of minimum.
	°F.	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*	*°F.*
January	57	64	51	54	65	44	52	65	39	54	66	42
February	60	70	53	57	70	47	56	68	41	59	72	46
March	63	70	55	62	75	50	60	73	46	64	78	50
April	66	74	59	70	83	55	67	82	52	70	85	55
May	71	79	64	77	91	61	75	90	60	77	93	61
June	76	82	69	82	95	65	85	101	69	85	101	68
July	79	85	73	83	97	69	90	104	77	92	106	77
August	80	86	74	83	95	69	89	102	76	91	104	77
September	79	85	72	78	90	66	83	97	69	84	100	70
October	75	82	69	74	86	63	71	86	56	73	87	58
November	68	75	61	66	76	54	61	75	46	62	76	49
December	61	68	54	59	68	48	52	66	38	56	68	44
Year	70	77	63	70	83	58	70	84	56	72	86	58

[a] The Delta of the Nile, in which the bulk of the Egyptian cotton crop is produced, lies between Cairo and Alexandria. Meteorological data are wanting for localities in the Delta itself, but the conditions are probably intermediate between those at Alexandria and at Cairo. Of the two localities in the southwestern United States for which data are given, Phoenix represents the Salt River Valley and Yuma the valley of the Colorado River. For the third important area which is believed to be well adapted to the culture of Egyptian varieties of cotton, i. e., the Imperial Valley, in southeastern California, the available records are not sufficient to serve as a basis for comparison.

Alexandria, on the Mediterranean coast of Egypt, has a less extreme climate than Cairo, which lies at the apex of the Delta of the Nile and almost touches the desert. The variation from season to season in mean temperatures and in the means of the maxima and minima is much smaller at Alexandria than at Cairo. Even at Cairo, however, the summers are decidedly cooler and the winters are somewhat warmer than at Phoenix and Yuma. The yearly means and means of the maximum and minimum temperatures are much alike at all four localities.

The table following shows the mean relative humidity of Alexandria and Cairo, Egypt, as compared with points in Arizona:

TABLE II.—*Mean relative humidity in percentages of saturation at localities in Egypt and in the southwestern United States.*

Month.	Alexandria, Egypt.[a]	Cairo, Egypt.[a]	Phoenix, Ariz.[b]	Yuma, Ariz.[b]
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
January	64	72	50	50
February	62	70	45	49
March	61	61	38	46
April	60	54	31	39
May	60	50	26	40
June	64	53	22	39
July	67	61	35	48
August	64	67	39	52
September	63	68	38	49
October	64	72	38	49
November	61	72	44	47
December	66	74	44	51
Year	63	64	38	46

[a] One observation made at 8 to 9 a. m., daily.
[b] Mean of two daily observations, at 5 a. m. and 5 p. m.

The above table is inserted because the humidity of the atmosphere at different localities is usually compared on the basis of percentages of possible saturation at the temperature prevailing when the observations are made; but there is reason to believe that the factor that vitally affects the growth of plants is the saturation deficit, i. e., the difference in weight between the amount of water vapor actually present in a given volume of the atmosphere and that required to saturate it at the mean temperature for the period under consideration. Hence the following table is likewise presented:

TABLE III.—*Mean saturation deficit (weight in grains of the additional water vapor required to saturate a cubic foot of air) at localities in Egypt and in the southwestern United States.*

Month.	Alexandria, Egypt.	Cairo, Egypt.	Phoenix, Ariz.	Yuma, Ariz.
	Grains.	*Grains.*	*Grains.*	*Grains.*
January	1.9	1.3	2.3	2.4
February	2.2	1.6	3.0	2.9
March	2.4	2.4	3.7	3.7
April	2.8	3.7	5.2	5.2
May	3.3	4.9	7.1	6.3
June	3.4	5.4	10.4	8.4
July	3.5	4.9	10.1	8.9
August	3.9	4.0	9.2	7.9
September	3.9	3.3	8.0	6.6
October	3.3	2.4	5.4	5.2
November	2.9	2.0	3.6	3.2
December	2.0	1.4	2.6	2.4
Year	3.0	2.9	5.2	4.6

During the summer months the saturation deficit is considerably greater at Cairo than at Alexandria, while in autumn and winter it is greater at Alexandria than at Cairo. At both Egyptian localities the saturation deficit throughout the year is much lower than at Phoenix and at Yuma, Ariz.

A curve representing the variation in the saturation deficit of the air from month to month throughout the year would be much the same for Alexandria and for Cairo. At both localities there is a rather gradual increase from the minimum in January to the maximum (which occurs in August and September at Alexandria, in June at Cairo), followed by a gradual decrease to the January minimum. A curve representing the variations from month to month at Phoenix and at Yuma would be on the whole similar, June to September being the months of maximum saturation deficit at these localities.

A characteristic feature of the early fall months in the Nile Delta are the heavy fogs, which often persist until 9 or 10 o'clock in the morning. This is a feature that is absent from the climate of the southwestern United States. When accompanied by excessive heat these fogs are said to cause premature dropping of the cotton bolls.

SOILS.

Egypt, to quote a familiar saying, is "the gift of the Nile." This is true in a double sense, since not only does the life of that nearly rainless country depend upon the water supplied by the river, but its agricultural soils are all of alluvial origin, being the accumulated sediment of countless Nile floods. As in the case of most alluvial soils, those of Egypt vary greatly in mechanical composition, according to the distance from existing or ancient stream channels at which they were laid down. Especially in the Delta region, clay loams and clays greatly predominate over other soils, but silt loams, loams, and sandy loams also occupy extensive areas, and near the edges of the desert almost pure sands occur. The clays and clay loams are mostly black in color and doubtless contain considerable organic matter. These soils, when dry, are apt to bake on the surface, thus giving up much moisture by evaporation, and to form deep cracks through which a great deal of water is lost by percolation. To prevent this the surface must be kept well mulched. All these soils are usually of a considerable depth, which is said to average 40 to 60 feet.[a]

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[a] In his "Physiography of the River Nile and Its Basin" (Cairo, 1906, p. 339), Capt. H. G. Lyons gives the thickness of the sediment, as determined by eighteen borings made in various parts of the Delta and Valley of the Nile, as far south as Luxor. The average thickness, as shown by these borings, is 43½ feet.

The heavier soils are preferred for cotton culture in Egypt, as they are more retentive of moisture and lose their plant-food components less readily by leaching when irrigated. The silt loams, which have these properties in a high degree and are at the same time much less difficult to work than the clay loams and clays, are probably the most valuable of Egyptian soils. On the average, cotton is grown on much heavier land than in the United States. On the light soils in Egypt both yield and quality of fiber are said to be inferior.

In point of soil fertility it is found that when an exhaustive crop like cotton is grown for any length of time the supply of nitrogen soon becomes insufficient and ultimately fertilizers containing phosphoric acid are also found beneficial. Potash seems to be almost always present in adequate amount.

Under the ancient irrigation system of Egypt, which consisted in turning the water of the Nile during its annual flood into a series of extensive basins, no diminution in soil fertility was observed. Under this system no other irrigation was ordinarily given and only one crop was grown annually, wheat or barley being alternated with beans or clover. The nitrogen furnished by the leguminous crop, together with the small percentage of this element contained in the heavy deposits of sediment[a] left in the basins after flooding, amply sufficed for the needs of the cereal crop. Nowadays the conditions are very different, since irrigations are given at frequent intervals, much more leaching takes place, less sediment is deposited, and cotton is extensively grown. Cotton is an exhaustive crop, especially under Egyptian conditions, since the seed, which contains about one-third of the nitrogen taken up by the cotton plant, is exported to Europe, with the exception of the small percentage that is required for planting.

As far as possible leguminous crops are grown in rotation, but even these fail to supply all the nitrogen required by the cotton plant, and the remainder must be obtained from other sources. The chief nitrogenous fertilizers available are barnyard manure and the débris of old villages, which contains nitrogen equivalent to 2 or 3 per cent of nitrate of soda. The supply of these materials is much smaller than the demand, however, and the need of commercial fertilizers is becoming every day more apparent.

Alkali resistance of the cotton plant.—In various parts of Egypt, especially in the northern part of the country, near the Mediterranean, alkali soils occupy extensive areas. Sodium chlorid (common salt) seems generally to constitute the bulk of the salts present. The reclamation of these soils by washing and drainage has been undertaken on a large scale, partly by the government and partly by private capital. Cotton, which is usually put in at the earliest possible moment on these "washed lands," has been shown by soil tests to be superior to most crop plants in its ability to withstand alkali. Near Alexandria a good stand of cotton was found by Means and Kearney to be growing where the first 2 feet of the soil contained 0.6 per cent of readily soluble salts, and occasional plants were able to withstand nearly 2 per cent.[a]

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[a] The Nile when highest carries in suspension at Cairo about 160 parts of solid matter per 100,000. This is a relatively small amount in comparison with that carried by the Colorado River at Yuma, Ariz., which averaged 700 parts per 100,000 throughout the year 1904. When we consider, however, that in Egypt the flood water stood in the basins for six weeks, depositing nearly all the material it held in suspension, we can infer that the total amount of sediment left behind was by no means insignificant.

The presence of a moderate amount of salt in the soil is generally considered in Egypt as beneficial to cotton. It is said to check the tendency to excessive growth, to hasten ripening, and to improve the length, strength, and color of the fiber.[b] Even when considerably more than 1 per cent is present the strength of the fiber is said not to suffer greatly, although the length is impaired.

VARIETIES GROWN.

The varieties of cotton known as "Egyptian" are unquestionably of American origin. They belong to the same botanical species (*Gossypium barbadense*) as the Sea Island varieties or to a closely related species. Like the Sea Island varieties they have yellow flowers, small, pointed, three-locked bolls (Pl. IV), and smooth black seeds. The bolls are chiefly borne at the ends of long branches rather than close to the main stem, as in most Upland varieties. The Egyptian varieties, as is shown in Plates II and III, make larger plants than do most American Upland varieties. It is said that in 1818 Sea Island cotton was introduced into Egypt from Georgia by a French agriculturist named Jumel and that from this source the present Egyptian varieties are descended.[c] Other authorities consider Egyptian cotton more nearly related to Peruvian cotton (*Gossypium peruvianum*), which was also formerly grown in Egypt.

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[a] See T. H. Means, "Reclamation of Alkali Lands in Egypt," Bulletin No. 21 of the Bureau of Soils, U. S. Department of Agriculture. Also T. H. Kearney and T. H. Means, "Crops Used in the Reclamation of Alkali Lands in Egypt," Yearbook, U. S. Department of Agriculture for 1902, pp. 573 to 588 (especially pp. 586 and 587).

[b] Fertilizers containing phosphoric acid are said to produce the same effects and to counteract the excessive vegetative growth caused by too liberal application of nitrogenous manures.

[c] In all likelihood they have originated by mutation or discontinuous variation, a phenomenon which would be very apt to appear in such narrow-bred local varieties as the Sea Island when transported to an entirely new environment. The suddenness with which recently created Egyptian varieties have appeared and the obscurity attending their origin lend further probability to this view. The relative fixity of their characters during the first few years in which they are extensively grown argues against a hybrid origin, hybrids between different species of cotton being notoriously difficult to "fix."

While closely resembling each other in many of their characters and constituting a well-defined type, at least from an agricultural and commercial point of view, several well-marked varieties of cotton now exist in Egypt. At the present time the varieties that are chiefly grown are Ashmuni, Mit Afifi, Jannovitch, and Abbasi.

Ashmuni.—Ashmuni is the oldest of the four varieties and was formerly the most widely grown, although now largely supplanted by more valuable kinds. Its fiber is relatively short (1⅛ to 1¼ inches), and possesses neither the strength, fineness, nor luster of the Mit Afifi. In color it is pale brown. It ripens earlier than the other varieties and is considered to be the one that is best adapted to the hot, dry climate of southern Egypt, where alone it is now grown. It gives about 30 per cent of lint in ginning. Its average yield per acre is low compared with that of the other varieties, and its fiber sells for about one dollar less per hundred pounds.

Mit Afifi.[a]—In acreage and the total value of its product the Mit Afifi far exceeds all the other varieties. At least 70 per cent of the total Egyptian acreage in cotton is of this variety.[b]

Mit Afifi is the standard variety of the country, so much so that when Egyptian cotton is referred to, this variety is ordinarily meant. It is considered the hardiest variety grown in the country and the one that is surest to give a good yield of high-grade fiber under a great diversity of conditions. Mit Afifi was brought into cultivation about thirty years ago, and is said to have originated from a variety, now little grown, known as Gallini, which was itself of American Sea Island origin, if the local tradition can be trusted. Mit Afifi resembles the Ashmuni variety in so many ways, however, that it is more likely to have originated directly from the latter. The Mit Afifi variety has very strong and fine, lustrous fiber, averaging 1⅜ to 1½ inches in length. When typical, it has a light brown color, more pronounced than that of Ashmuni. In Egypt it turns out in ginning from 33 to 35 per cent of lint and its yield on "good average soil" is said to be ordinarily from 500 to 600 pounds of fiber to the acre.

Jannovitch.—This is the most recent variety that is extensively grown. It is said to have developed about thirteen years ago as a cross between Mit Afifi and Gallini, although more likely a mutation from one or the other. It is considered to surpass all other Egyptian varieties in the strength and fineness of its fiber, as well as in length.

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[a] Pronounced as if spelled Mit Afeefy.

[b] In 1906, 75.5 per cent of the total crop was Mit Afifi, 15 per cent Ashmuni, 5.5 per cent Jannovitch, and 2.7 per cent Abbasi.

averaging 1½ to 1⅝ inches. Its silkiness, luster, and delicate cream color make it one of the most beautiful cottons in existence. The quality of the fiber from the different pickings is said to be more uniform in this than in the other Egyptian varieties. In yield per acre it is inferior to Mit Afifi, the difference amounting, it is said, to 10 per cent. In ginning, its percentage of lint falls below that of Mit Afifi, averaging 30 to 31½. Notwithstanding this fact, Jannovitch generally brings from $2 to $2.50 more than Mit Afifi per 315 pounds of seed cotton (the unit on which prices are based in Egypt). This variety is said to succeed best on the more or less salty land near the seacoast. It is regarded as more liable than Mit Afifi to premature opening of the bolls and loss of fiber. In 1902, however, when conditions in Egypt were generally unfavorable to cotton, Jannovitch suffered less than did Mit Afifi.

Abbasi.—The Abbasi much resembles the American Sea Island varieties. It has a fine, silky fiber, pure white in color, and somewhat longer but not so strong as that of Mit Afifi. The percentage of lint is about the same as in Mit Afifi. In the Abbasi variety the lint obtained at the first picking is said to be of much better quality than that from later pickings, the difference in this respect being more marked than in other Egyptian varieties. First picking Abbasi sometimes sells for a higher price than any other Egyptian cotton. Abbasi is reputed to be more drought resistant than Mit Afifi and under favorable conditions to give heavier yields. The bolls of Abbasi are exceptionally long and sharp pointed.

Nubari.—Very recently a variety known as Nubari has originated in the Nile Delta. It is described as intermediate between Mit Afifi and Jannovitch, having stronger and more lustrous fiber than the former.

QUALITY AND GRADES OF EGYPTIAN COTTON.

Many grades of each variety are distinguished by importers of Egyptian cotton. The cotton is graded twice, once before ginning and again at Alexandria, where it is rebaled for export. Such characters as strength, fineness, uniformity, color, luster, and percentage of waste are all taken into account in fixing the grade to which a particular sample belongs. The length appears to vary but little in the different varieties. The amount of "trash" present is a very important factor in grading this class of cotton.

Much anxiety has recently been felt in Egypt on account of the evident deterioration of the leading varieties. Mit Afifi especially is showing much less constancy than formerly in the brown color of its fiber, a character that is of much importance in this variety. Spinners also complain that the twist of the fiber, upon which its strength largely depends, is becoming less pronounced. Even recently created varieties like Abbasi and Jannovitch are every year less true to type. The belief in Egypt is that this degeneration is due primarily to lack of care in the choice of seed for planting. It is thought that only careful selection can preserve and improve the varieties and this is now being undertaken both by the government and by individual growers. Special attention is being given to keeping up the brown color and other characters of Mit Afifi, which is justly regarded as the standard Egyptian cotton.

CULTURAL METHODS.

Owing to the cheapness of labor in Egypt, fifteen cents a day being the ordinary wages, the cultural methods in use there could not be followed in the United States without considerable modification. Nevertheless, a brief description of the Egyptian system will undoubtedly afford useful suggestions to those intending to grow cotton under irrigation in the Southwest.

PREPARATION OF THE LAND.

A two-year rotation is most frequently practiced in Egypt and is generally as follows: During the first year, clover (berseem) is grown as a winter crop, followed by cotton in summer. When the cotton is removed, a winter crop of either beans or wheat is sown and is harvested the following June. The land is then either left fallow during the second summer or corn is sown in July as a "flood crop,"[a] and is followed by berseem sown in the autumn. In the third spring cotton is again planted. Formerly it was more common to use a three-year rotation, which resembled the preceding, except that during the second winter either beans or clover were grown and during the third winter wheat or barley, followed by a second crop of corn.

When cotton follows corn or a fallow the land can be put into excellent shape for planting, being generally plowed in the fall as soon as the corn is removed. But if cotton is to be planted immediately after clover, the conditions are likely to be less satisfactory. Much of the cotton is grown by small farmers who are unwilling to plow up the clover upon which they mainly depend for forage for their domestic animals until just before the time arrives for planting cotton. Consequently, the land is apt to be full of undecomposed roots and to be wet, plowing up into clods. A poor stand of cotton and much replanting are the results. Except on the least fertile soils, it is found that the cotton crop is injured rather than benefited by immediately following clover. An intervening crop of grain or a period of fallow is necessary to secure the greatest possible benefit from the clover.

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[a] This late planting allows the corn crop to be abundantly irrigated throughout its growth, the Nile being at flood during the late summer and early fall months. During the first part of the summer, when the river is lowest, it is often necessary to devote all the available water to the cotton crop, to which, if necessary, everything else is sacrificed.

The importance of thorough preparation of the land before planting cotton is fully appreciated in Egypt. Cotton roots descend deep into the soil, and it is found that the deeper the plowing has been the better the plants withstand drought in case of a shortage of irrigation water. On large estates steam plows are now generally used, and the soil is turned over in the fall to a depth of 12 inches. But the great bulk of the cotton acreage is worked with the primitive plow of the country, drawn by a team of oxen, which loosens the soil to a depth of only about 6 inches, without turning it. If, as is now often practiced, a second plow follows the first in the same furrow, the soil can be worked to a considerably greater depth. Four plowings, two at right angles to the others, are usually given in preparing land for cotton. After plowing, the soil is frequently harrowed and then rolled to break up clods. Care is taken, however, not to pulverize the heavier soils too thoroughly, as in that case they tend to bake and crack, thus losing much moisture.

When these operations are completed the land is at once ridged. Ridging is usually done with the native plow, the width of the furrow being increased by stuffing sacking or some other bulky material into the angle between the beam and the share. The ridges are then shaped into beds by men working with the "fass," or short-handled hoe, a tool that is indispensable to the Egyptian agriculturist. The beds are usually made about 36 feet long, this being the average distance between the borders that intersect the beds at right angles, dividing the field into "lands" for irrigation. Cotton is irrigated by the furrow method in Egypt, and this is usually managed so that six or seven furrows can be irrigated together.

Farm manure, which costs about 20 cents a ton in most parts of Egypt, when used at all is put on at the rate of 10 to 15 tons to the acre. Old, well-rotted manure is preferred. Most frequently the manure is applied after the plants are above ground, being either hoed into the furrows or scattered at the roots of each plant, a laborious operation, only possible in a country where labor is as cheap as it is in Egypt. Often, however, the manure is put on before planting. Sometimes it is spread before the ridges are made, but more frequently it is placed in the furrows and subsequently covered up by splitting the ridges. Where cotton immediately follows a crop of berseem, manure is not generally used.

PLANTING.

Planting is done chiefly in March, although, especially in southern Egypt, it sometimes begins as early as the 10th of February. There is a general conviction in Egypt that early planting gives the best results, the stand being better and the plants producing less wood in proportion to fiber. It is believed that better yields and a better quality of fiber are thus obtained. The cold winds frequent in March are said to cause least injury to early-sown cotton. As far as possible replanting should be avoided, since it is difficult to manage the earlier irrigations without injury to some of the plants if these are in different stages of growth.

Cotton is planted closer than in the southern United States, notwithstanding the fact that the plants of Egyptian varieties make a larger growth than American Upland varieties. The average distance between the rows is only about 2½ feet and the "hills" are usually 15 or 16 inches apart in the rows, with two plants in each hill. Hence the average number of plants to the acre is about 26,000. The general opinion in Egypt is that even in the best soils the distance between the rows can not be made more than 3 feet or that between the "hills" more than 2 feet without diminishing the yield.

Seed is planted at an average rate of 1¼ bushels per acre. It is put in on the side of the furrow, about two-thirds of the distance from the bottom. In planting, a man with a "fass," or short-handled hoe, goes up and down the rows, making holes at intervals of 15 or 16 inches. He is followed by a boy, who drops into each hole 8 or 10 seeds, covering them to a depth of 2 or 3 inches. Usually ten or twelve days are required for germination.

IRRIGATING.

A watering is usually given immediately after planting, although sometimes the field receives an irrigation just before planting is begun. In the latter case the furrows are filled about two-thirds full and the seed is put in along the high-water mark. When the second or "wet" method of planting is followed, it is easier to put in the seed at a uniform level, but on the other hand the land becomes so dry before it is possible to determine whether replanting will be necessary that another irrigation must first be given, and this delays replanting a week or ten days longer.

The second irrigation generally takes place about thirty-five days after planting. It is found that the best results are obtained if this watering is postponed as long as can be done without injury to the plants. This causes the roots to strike deep into the soil from the outset, stimulates the plant to branch from the base, and prevents the lower part of the stem from making a soft and weak growth which is later unable to hold up the weight of bolls. This watering is a light one, the water not being allowed to stand high enough in the furrows to reach the plants. From twenty-five to thirty days elapse between the second and third irrigations and about twenty days between the third and the fourth. The fourth usually occurs some time between May 20 and the 1st of June. Thereafter, until the end of August, two waterings monthly are generally given. When the Nile is very low, however, it is sometimes necessary to increase the interval between irrigations to three weeks and to restrict the amount of water that can be applied each time.

Altogether, ten irrigations are commonly given between the date of planting and that of the first picking, care being taken so to time the last watering that the soil will become dry before picking should begin. A watering is given as soon as the first picking is completed, and often one between the second and third pickings. It is estimated that cotton receives at each watering about 3½ acre-inches, or an average total of 3 to 3½ acre-feet of water during the whole season.

The tendency in Egypt, as in other countries where irrigation is practiced, is to apply more water than the crop really needs. Excessive irrigation causes too rank a growth, dropping of the bolls, and late ripening, besides injuring the quality of the fiber. It is well known that in years when the water supply is low and the amount of water that can be applied is restricted by the irrigation service, the crop is frequently larger and of better quality than when a freer use of water is permitted. Thus, in 1899, when the Nile was unusually low, it was observed that in many localities the fiber was longer and finer than that produced the year before, when water for irrigation was more plentiful. There is a minimum, however, below which it is not safe to go in irrigating cotton. In localities where the supply of water is normally small it was quite inadequate in 1899. As a result, the plants were abnormally small, the yields were low, and the fiber was short. It is interesting that in 1899 the product was most inferior in the very districts which in ordinary years have the highest reputation for the quality of their cotton. On the other hand, districts where an excessive amount of water is generally used and where the quality of the fiber is usually inferior, produced the best cotton grown in Egypt in 1899.

CULTIVATING.

Cultivating is performed entirely by hand in Egypt, even on the large estates where modern machinery is used in other agricultural operations. In fact, the cotton rows are too close together to allow the use of a horse cultivator for any considerable length of time after the plants are above ground. The work of cultivating is very onerous, owing to the universal use of a short-handled hoe, which requires the laborer to assume a stooping position.

On well-managed farms a hoeing is given as soon as the plants are well above ground. It is considered desirable to thin the rows before the second watering, which, as we have seen, is given about thirty-five days after planting. The two strongest plants are then left in each "hill." At the same time some farmers give the beds another hoeing. When the soil has dried sufficiently after the first watering that follows planting, the second (or third) hoeing is given. In the practice of many farmers, however, this is the first hoeing that is given. The third (or fourth) hoeing follows the third irrigation (sixty or sixty-five days after planting), and the fourth (or fifth) hoeing takes place after the fourth watering (eighty to eighty-five days after planting). This is usually the last hoeing, the growth of the plants thereafter making tillage impracticable. From that time until the first picking begins the crop requires no labor except that involved in irrigating. More frequently only three or four hoeings are given, either the first or second, as above described, and sometimes both being omitted by all but the best farmers.

The hoeings are so managed that earth is each time brought up around the plants from the opposite edge of the furrows, which are thus gradually moved in one direction across the field. Consequently the plants, which at the outset stood on the slope of the furrows at the edge of the beds, are at the top and in the center of the beds by the time the third hoeing is completed.

PICKING.

Cotton picking begins in southern Egypt before the end of August, but in the Delta region, where the bulk of the crop is grown, the first picking generally commences about September 10. A second picking is made in October and a third in November. Sometimes a fourth picking is made, while occasionally the whole crop is harvested in two pickings. It is considered especially important with Egyptian cotton to begin picking as soon as enough bolls are ripe to make it worth while, since long exposure to the sun is said to cause the brown color to fade. As a rule 35 per cent of the total crop is harvested at the first picking, 45 per cent at the second, and 20 per cent at the third, but these proportions vary considerably from year to year. The fiber from each picking is graded and marked separately, that from the first picking being generally the best and that from the third picking the poorest. This work is done largely by children, who pick on an average 30 to 40 pounds of seed cotton a day, for which they are paid at the rate of 18 to 20 cents per hundred pounds. The seed cotton is packed in sacks holding about 100 pounds and is then ready for shipment to the ginnery.

GINNING AND BALING.

The product is generally sold where it is grown, as seed cotton, and is transported by the buyer to one of the ginneries which are located in various parts of the cotton-growing region. Most of these establishments operate a large number of gins. Some of them have a daily capacity of 300 Egyptian bales (about 200,000 pounds of lint).

As in the case of Sea Island cotton in the United States, the roller gin alone is used, since the saw gin employed for American Upland cotton injures the long-staple Egyptian varieties. The ginned fiber is shipped, usually in rough bales, to Alexandria. There it passes through compresses and is turned out in the neat bales, bound with eleven hoops, in which Egyptian cotton reaches the European and American markets. These bales, although smaller than the average American compressed bale, weigh from 700 to 800 pounds. They are about one and one-half times as compact as the American bale, the average density being 35.8 pounds per cubic foot in the Egyptian and 23.6 pounds in the American bale.

YIELDS AND MARKETS.[a]

The cotton production of Egypt is large in proportion to the area annually devoted to this crop, which during the four years from 1903 to 1906 averaged 1,500,000 acres. Practically the entire crop, both lint and seed, is shipped to Europe and America, so that the statistics of exports fairly represent the total production of the country. During the nine years from 1898 to 1906 the total exports averaged 611,872,285 pounds of fiber. Assuming that the area in cotton during these years averaged 1,500,000 acres, the yield per acre for the whole country during this period was about 408 pounds.[b] When carefully chosen seed of good varieties is used and the soil and cultural conditions are favorable, yields of 800 and, in exceptional cases, of even 1,100 pounds of fiber are obtained.

Of the total exports of cotton from Egypt during the nine years from 1898 to 1906 about 50 per cent went to the United Kingdom (Great Britain and Ireland). The United States was among the heaviest importers, ranking third in 1902 and second in 1903. Russia, Austria, France, and Italy also imported large quantities. Nearly all of the principal countries in Europe obtain cotton from Egypt, and even India and Japan receive some of the product.

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[a] The statistics given in the following pages were furnished by Mr. G. K. Holmes, Chief of the Office of Foreign Markets, Bureau of Statistics, U. S. Department of Agriculture.

[b] In 1904 Mr. George P. Foaden estimated the average yield per acre at about 410 pounds. See Bulletin No. 62 of the Bureau of Plant Industry, 1904, p. 43. Mr. A. A. Haserick estimated the average yield per acre to have been only 360 pounds in 1905.

The importation of cotton from Egypt into the United States has been very considerable in recent years. In 1902 the high-water mark of 81,325,158 pounds was reached, but this figure was very nearly equaled in 1907, when 78,783,913 pounds were imported.

The following table shows the amount imported during each of the ten years from 1898 to 1907:

TABLE IV.—*Imports of cotton fiber from Egypt into the United States during the years 1898 to 1907, inclusive.*

Year.	Pounds.
1898	38, 165, 061
1899	37, 506, 062
1900	53, 554, 586
1901	34, 735, 682
1902	81, 325, 158
1903	63, 554, 773
1904	39, 249, 878
1905	52, 436, 673
1906	57, 860, 814
1907	78, 783, 913
Average	53, 717, 260

In addition, there has been during the same period an average yearly importation into the United States of cotton from the United Kingdom to the extent of 8,536,357 pounds. The greater part of this is undoubtedly Egyptian cotton.

The table that follows gives the average price per pound of Egyptian cotton in the Alexandria, Liverpool, and Boston markets during each of the ten years from 1898 to 1907. The Alexandria prices are those of cotton that was exported to the United States. The Liverpool prices are those of "good, fair Egyptian." For comparison the average prices of American Middling Upland on the Liverpool and Boston markets during the same period are added.

TABLE V.—*Average prices, in cents per pound, of Egyptian and American Middling Upland cottons on the Alexandria, Liverpool, and Boston markets, from 1898 to 1907, inclusive.*

Year.	Egyptian.			American Middling Upland.	
	Alexandria.	Liverpool.	Boston.	Liverpool.	Boston.[a]
	Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1898	9.3	9.0	10.1	6.7	5.9
1899	9.9	10.7	11.5	7.2	6.5
1900	11.5	15.0	14.7	11.1	9.5
1901	15.0	11.8	13.5	9.6	8.7
1902	11.7	13.9	13.7	9.7	8.9
1903	14.6	17.8	16.1	12.2	11.0
1904	17.9	16.2	17.3	13.4	12.5
1905	15.6	14.8	15.9	10.3	9.3
1906	15.5	19.8	18.7	14.1	11.0
1907	20.3	21.4	21.9	13.2	11.8
Average	14.1	15.0	15.3	10.7	9.5

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[a] Mean closing prices for "spot" cotton, compiled from the "Commercial and Financial Chronicle" (published in New York).

The table shows that during the last ten years there has been an advance in the price of Egyptian cotton corresponding closely to the rise in price of American Upland cotton. The ruling price for the latter evidently largely determines that at which Egyptian cotton is quoted. The difference between the Alexandria and the Boston prices, averaging 1.2 cents per pound, presumably represents the cost of transportation, insurance, and other fixed charges between these ports.

The average price of Egyptian cotton on the Boston market during the past ten years has been a little more than one and one-half times that of American Middling Upland, but in 1907 Egyptian cotton sold on the average for nearly twice as much as Upland. It must be remembered that there is a great diversity in Egyptian cotton, some of it bringing much higher prices than are represented by the average for the "good fair" grade. It is a conservative estimate that Egyptian cotton of the quality which experiments have demonstrated can be produced in the southwestern United States will be worth more than one and one-half times as much as Middling Upland cotton. In 1903, when the price of "good fair" Egyptian averaged 14½ cents per pound at Alexandria, a cotton buyer at that place estimated the Jannovitch grown the year before at Calexico, Cal., as worth 21 to 22 cents.

USES OF EGYPTIAN COTTON BY AMERICAN MANUFACTURERS.[a]

The variety of Egyptian cotton that is most used by American manufacturers is Mit Afifi, which constitutes at least three-fourths of the total imports. The grade most largely used averages 1⅜ inches in length and furnishes numbers of yarns up to 70's and 80's. Jannovitch, and to a small extent Abbasi, averaging 1½ to 1⅝ inches in length of fiber, are used as a substitute for the lower grades of Sea Island in manufacturing fine yarns (100's and upward). A small quantity of the inferior Ashmuni variety is also imported.

There are four principal reasons for the extensive use of Egyptian cottons in the United States: (1) They are best adapted to mercerizing and other processes that give a high finish to the cloth and cause it to resemble silk; (2) their exceptional clearness (freedom from nep) and luster, as well as their capacity for taking dyes, fit them for mixing with silk and for filling sateen, India linens, and similar goods having a brilliant surface; (3) the brown color of Mit Afifi fiber allows it to be used without dyeing in manufacturing goods such as Balbriggan underwear[b] and lace curtains, in which the ecru shade is desired; (4) they can be used for the manufacture of sewing thread and other articles which need to be very strong and for which no other type of cotton but Sea Island is suitable. Owing to the higher price of the latter, Egyptian cottons can in many cases be advantageously substituted.

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[a] Based upon information obligingly furnished by some thirty of the principal importers and manufacturers of Egyptian cotton in the United States.

[b] Although less in demand for this purpose than formerly.

Among the various classes of goods wholly or partly made from Egyptian cottons may be enumerated lawns, sateens, twills, serges, and fabrics for covering umbrellas, as well as other highly finished cotton cloths. In these goods they are used largely as weft or filling. They are especially suited for making heavy fabrics that must also be soft and fine. Their fineness and luster adapt them to mixing with silk in cloths, floss, and braids. They are largely used in the manufacture of sewing thread and of fabrics for insulating and for bicycle and automobile tires.[a] The lower grades of Mit Afifi are much employed for hosiery yarns.

Except in cases where the brown-colored fiber is especially desired there seems to be little reason for preferring Egyptian to Sea Island cotton, although one manufacturer reports that within the range of the numbers used, the former furnishes a cleaner and better-looking filling than either Sea Island or Peeler (long-staple Upland) cottons. The highest grades of Sea Island have longer and finer fiber than any other cotton and therefore make stronger and finer yarns and thread. For these grades the Egyptian can not be substituted,[b] but in manufacturing various classes of goods the somewhat lower price of Egyptian cottons allows them to be used to advantage in place of the lower grades of the Sea Island, especially when the supply of the latter is below the normal.

On the other hand, manufacturers seem to be generally agreed that for a number of purposes the Egyptian types can not be replaced by American long-staple Upland or Peeler cottons. The former have fiber that is stronger, finer, and more lustrous or "classy" than corresponding lengths of the long-staple Uplands, and give yarns, thread, and cloths that are stronger and clearer (i. e., freer from "nep") than can be made from the latter.[c] There seems to be no question of the superiority of the Egyptian over the long-staple Upland varieties in manufacturing strong sewing thread and cloths in which a smooth, lustrous finish is desired.

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[a] When prices permit, however, Sea Island is preferred for the last purpose, except for the manufacture of goods that are not to be exposed to very hard usage.

[b] One manufacturer of thread states: "We do not know of any Egyptian cotton which can successfully compete with Sea Island for counts [of yarns] finer than No. 110's."

[c] This freedom from nep or knots is one of the most desirable characteristics of goods manufactured from Egyptian cotton. It is somewhat questionable, however, whether it is not partly due to the fact that in Egypt roller gins are exclusively used in separating the fiber.

Apart from specific qualities of the fiber, American manufacturers give other reasons for preferring Egyptian cotton. They state that it is usually more carefully ginned, graded, and baled and is apt to be freer from trash and short fiber, hence giving less waste in carding and combing than either Sea Island or long-staple Upland cottons. Egyptian cotton is also esteemed for its evenness of staple, the different grades showing little variation in this respect from year to year.

EGYPTIAN COTTON CULTURE IN THE UNITED STATES.

AREAS ADAPTED TO THIS TYPE OF COTTON.

The Egyptian varieties are apparently best adapted to culture under irrigation in regions where there is practically no rainfall during the growing season. The only part of the United States where these conditions exist and where at the same time the summers are long and hot enough for profitable cotton culture is the extreme Southwest, from western Texas to southern California.

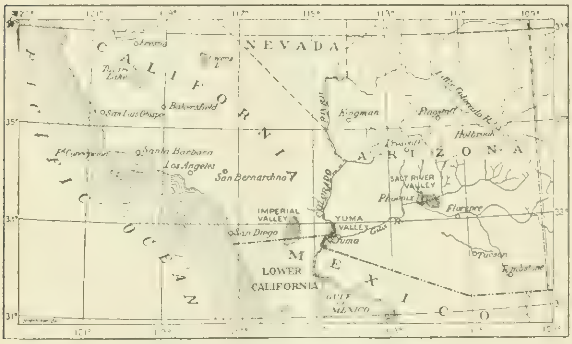

FIG. 1.—Map of Arizona and southern California, showing the location of the Salt River, Yuma, and Imperial valleys.

Since this type of cotton will continue to produce bolls and ripen fiber until a hard frost occurs, it is obvious that the largest yields can be obtained in regions where the autumn temperatures are highest. We must therefore conclude that the greatest success with Egyptian cotton is to be expected in southern Arizona and southeastern California—a conclusion that is supported by the experience so far gained. The valleys of the Salt River and of the Colorado River (Yuma Valley) in Arizona and the Imperial Valley in California have been found to be admirably adapted to the production of this type of cotton. The location of these districts is indicated on the map (fig. 1). It will be well to note briefly the physical characteristics of this region before proceeding to a discussion of the experiments that have been carried on there with Egyptian cotton.

CLIMATE.

Meteorological records covering periods of several years are available for Phoenix and Yuma, Ariz. Data as to temperatures and atmospheric humidity at these localities have already been given in connection with the discussion of the climate of the cotton-growing district in Egypt. These two stations represent, respectively, the Salt River Valley and the Yuma Valley. In the Imperial Valley observations have been taken only during the past three years and under conditions that make a direct comparison with Phoenix and Yuma of doubtful value.

Temperatures (see Table I) are slightly higher at Yuma than at Phoenix, the annual mean temperature, mean of the maximum, and mean of the minimum temperatures being each 2 degrees F. higher at the former locality. At Yuma the mean of the annual absolute maximum temperatures is 113° and that of the annual absolute minimum temperatures is 29° F. It should be noted, however, that in the Yuma Valley itself the minima are undoubtedly lower than at the Yuma Weather Bureau station where observations are taken, the latter being situated at a somewhat higher elevation, adjoining the mesa which borders the valley. Severe frosts frequently occur in the valley from the middle of November to the first of March.

The rainfall at both Phoenix and Yuma is so small as to be practically negligible from the point of view of cotton culture. At Phoenix it is 6.8 inches yearly, while at Yuma the average is only 2.7 inches. The difference is most pronounced in the summer and early autumn, when there is considerable precipitation in the Salt River Valley, but practically none in the valley of the Colorado.

As regards atmospheric humidity (see Tables II and III), the air normally contains considerably more moisture at Yuma than at Phoenix. This is true in every month of the year except January, although the difference is most pronounced during the months from May to September. The mean annual relative humidity (in percentages of saturation) is 38 at Phoenix and 46 at Yuma. The mean annual absolute humidity (in weight in grains of the water vapor in a cubic foot of air) is 2.8 at Phoenix and 3.9 at Yuma.

In the Imperial Valley the temperatures are probably normally higher than at either Phoenix or Yuma. This is indicated by the fact that in 1906 the annual mean of the maximum temperatures at Heber (8 miles south of Imperial and 57 miles due west of Yuma) was 88° F., while at Yuma it was 85° and at Phoenix 83° F. On the other hand, the annual mean of the minimum temperatures was the same at Heber as at Phoenix (56° F.), but was 2 degrees lower than at Yuma. The annual mean temperature at the three localities in 1906 was as follows: Heber and Yuma, 72°; Phoenix, 70° F.[a]

The rainfall in the Imperial Valley is probably about the same as at Yuma. At Salton, Cal., the nearest locality at which measurements have been made during a series of years, the average total yearly rainfall is 2.5 inches.

Data are lacking for a satisfactory comparison of the atmospheric humidity in the Imperial Valley with that in the Salt River and Yuma valleys, but there is reason to believe that the air is normally drier in the Imperial Valley than at either of the Arizona localities.

As has already been remarked, the climate of southern Arizona and southeastern California is more extreme than that of the portion of Egypt where cotton culture is carried on, the summers being hotter and the winters colder; furthermore, the mean humidity of the atmosphere is much lower in the southwestern United States than in the Delta of the Nile. In Egypt the comparatively moist condition of the atmosphere that prevails during the period when cotton is ripening is considered an important factor in the production of a high quality of fiber, but experience in the southwestern United States has demonstrated that the Egyptian varieties of cotton can adapt themselves to a much drier atmosphere than that prevailing in the Nile Delta without injury to the quality of their fiber.

In point of temperature the climate of southern Arizona and southeastern California is an ideal one for cotton of the Egyptian type, which differs from Upland varieties in requiring a much longer season and a much greater sum total of heat in order to produce its maximum yield of fiber. The usual absence of killing frosts after the 1st of March makes it possible to plant earlier than in most parts of the cotton belt of the United States. The long, very hot summer permits the formation of the greatest possible number of bolls. Finally, the warm weather that ordinarily prevails until the 1st of December is highly favorable to ripening and allows four or five pickings to be made.

Another great advantage in growing this type of cotton in the Southwest is the very small precipitation. Cotton growing under rainfall has certain disadvantages that are avoided when the crop is produced under irrigation in a nearly rainless region. In the main cotton belt of the United States preparation for planting must often be delayed until the ground dries out sufficiently to be worked. Dry spells may occur in spring when the plants should be making their most vigorous growth. Prolonged wet spells in late summer and early fall may retard ripening, interfere with picking, and injure the ripe fiber by beating it out of the open bolls and discoloring it. Under irrigation in regions of little rainfall these drawbacks are avoided. The soil moisture is under the control of the farmer. By giving relatively large amounts of water during the early stages the plants are stimulated to make a vigorous growth. Later in the season, the production of bolls and the ripening of the fiber can be hastened by using water sparingly. Furthermore, the ground need never be wet at the time when picking should commence, and there is no danger of the discoloration of the fiber through a period of rainy weather at the time of ripening. This is a very important consideration as regards the principal Egyptian varieties of cotton, in which good color is a valuable characteristic.

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[a] In comparing these records it must be borne in mind that at Heber the observations were made at a height of only 5 feet from the surface of the ground, while at Yuma they were made at a height of 16 feet, and at Phoenix of 47 feet.

Apart from the general advantages that irrigation affords in connection with cotton growing there is some reason to believe that it is characteristic of the Egyptian varieties to give better results when grown in regions of small rainfall where artificial watering is necessary. An expert on the subject in Egypt [a] told one of the writers in 1902 that Egyptian varieties, when tested in the Sudan, underwent from 15 to 20 per cent of deterioration in localities where the rainfall was sufficient to produce a crop, but deteriorated only 2 to 3 per cent where irrigation had to be practiced. In the former case the staple was shorter and the seeds tended to become covered with short fiber.

SOILS.[b]

The soils of the Salt River, Yuma, and Imperial valleys vary in texture from a sandy loam to a heavy clay, or adobe. In the Imperial Valley the average soil is heavier than in the Salt River and Yuma valleys, resembling much of the soil of the Nile Delta. These soils often show great diversity in a field of a few acres, the variation being especially noticeable when the land is first brought under cultivation. The lighter soils are generally regarded as the best for cultivated crops; they work readily, are easily kept in a tillable condition, and can be cultivated soon after irrigation.[a] The heavy soils are well adapted to growing alfalfa and cereals. It may be observed that the physical condition and water-holding capacity of most southwestern soils could be greatly improved by the addition of organic matter in the form of barnyard manure, by plowing under green-manure crops, or by including alfalfa in a long-period rotation.

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[a] Mr. Benachi, of the firm of Choremi, Benachi & Co.

[b] For a fuller account of the soils of the Colorado River region, the reader is referred to the following publications of the Bureau of Soils, United States Department of Agriculture: (1) Soil Survey in Salt River Valley, Arizona, by Thomas H. Means; Field Operations of the Division of Soils in 1900, pp. 287 to 332, 1901. (2) Soil Survey around Imperial, Cal., by Thomas H. Means and J. Garnett Holmes; Field Operations of the Bureau of Soils in 1901, pp. 587 to 606, 1902. (3) Soil Survey of the Yuma Area, Arizona, by J. Garnett Holmes; Field Operations of the Bureau of Soils in 1902, pp. 777 to 791, 1903. These publications give the area and distribution of the different types of soils in the three valleys and also the area and distribution of the different grades of alkali soils.

While for the most part the soils of the Salt River, Yuma, and Imperial valleys are naturally very fertile, it is probable that if cotton becomes an important crop in the region leguminous crops will have to be grown in rotation with it in order to keep up the supply of nitrogen, since the cotton plant draws heavily upon this element.

Alkali is found in more or less injurious quantities in various parts of these three valleys. As a rule the alkali accumulations are found principally in the upper 3 or 4 feet of soil and are often largely concentrated in the surface foot, to which they are raised by capillary activity, aided by the great evaporation which is characteristic of that region. The alkali is chiefly the less injurious "white alkali," consisting mainly of sodium chlorid and sodium sulphate. "Black alkali" (sodium carbonate), which gives the soil an alkaline reaction in the true chemical sense, is seldom present in dangerous quantities. It is probable that only a small percentage of the total area capable of irrigation in the Salt River, Yuma, and Imperial valleys contains enough of these salts to seriously hinder the growing of cotton, which, as has already been stated, is one of the most alkali-resistant crop plants.

WATER SUPPLY.

In the Salt River Valley the area at present in cultivation, which was estimated in 1900 to amount to 120,000 acres, is supplied with water by a number of canal systems that have been established by private capital. The United States Reclamation Service has recently undertaken the irrigation of this valley, and is now constructing a great impounding dam on the Salt River above Phoenix, which will increase the acreage under irrigation and insure an adequate supply of water at all times. The Government system is expected to provide water for irrigating 200,000 acres of land, including that which is now in cultivation.

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[a] In Egypt, however, the heavier soils are preferred for cotton culture.

In Yuma Valley only about 3,000 acres are now under irrigation throughout the year, all of this land being situated within a few miles of the town of Yuma. The water used in irrigating this area is pumped from the Colorado River. The United States Reclamation Service is now constructing an irrigation system, including a large diversion dam on the Colorado, which will provide gravity water for approximately 90,000 acres, four-fifths of which is located on the Arizona side of the river.

The Imperial Valley comprises approximately 500,000 acres of irrigable land in the United States, of which about 100,000 acres were actually under irrigation in 1905. This area is supplied with water from the Colorado River, the irrigation system being owned by a private corporation.

There are also a number of smaller areas along the Colorado and Gila rivers that are, or can be, irrigated with water from these rivers.

The total area that will be under ditch in the course of a few years in the Colorado River region can be conservatively estimated at 600,000 acres. During the last ten years the United States has imported an average amount of Egyptian cotton equivalent to about 120,000 American bales. Since the performance of the Mit Afifi variety at Yuma in 1907 gives good ground for anticipating yields of one to two bales to the acre in this region, it may be reasonably expected that one-fifth of this estimated total acreage will be able to supply the normal American demand for cotton of the Egyptian type.

Other districts in the Southwest where cotton can be grown under irrigation, but where the spring and fall temperatures are perhaps too low for the greatest success with Egyptian varieties, are the Pecos Valley in western Texas and eastern New Mexico and the southern part of the San Joaquin Valley in California.

EXPERIMENTS IN THE SOUTH ATLANTIC AND GULF STATES.

Seed of the principal Egyptian varieties of cotton (Mit Afifi, Jannovitch, Abbasi, and Ashmuni) has been several times imported by the Department of Agriculture and furnished to individual growers in various parts of the southern and southwestern United States. In 1900 and 1901 Mr. L. H. Dewey, in charge of fiber investigations, received numerous reports of trials of seed distributed by the Department of Agriculture which indicated that in the humid portion of the cotton belt little success could be anticipated with the Egyptian varieties. An excellent quality of fiber was produced at several localities, but the yields were generally small, due largely to the shortness of the season, which prevented many of the bolls from ripening. In many cases planting was delayed by wet weather in the spring, and killing frosts occurred so early in the fall as to cut off a large part of the crop.[a]

Dr. Herbert J. Webber [b] experimented for several years with Egyptian varieties in the humid section of the United States, especially in South Carolina and Texas. His results also indicate that these varieties can not be profitably grown anywhere in the main cotton belt, at least not without adaptation through several years of acclimatization and selection.

PRELIMINARY EXPERIMENTS IN THE SOUTHWEST.

Experiments carried on in Arizona by the Territorial Agricultural Experiment Station and by individual farmers previous to 1902 pointed to the conclusion that heavy yields of Egyptian cotton of high quality could be obtained under irrigation in the warmer part of the arid region. The Abbasi, Mit Afifi, and Jannovitch varieties were grown by Prof. A. J. McClatchie on the station farm at Phoenix and were productive in the order named, Abbasi yielding at the rate of 460 pounds of lint to the acre. The Lowell Textile School reported that the Mit Afifi cotton grown at Phoenix, as compared with imported Mit Afifi, gave 4 per cent less waste and furnished thread that was 14 per cent stronger.

In 1902 preliminary experiments were made by Messrs. Webber and Kearney, of the Bureau of Plant Industry, at a number of localities in the Southwest as follows: Mit Afifi variety at San Antonio and Barstow, Tex., and at Carlsbad, N. Mex.; Jannovitch variety at Barstow, Tex., Carlsbad, N. Mex., Yuma, Ariz., and Calexico, Cal., and Ashmuni variety at Del Rio, Tex. In addition, Doctor Webber experimented in the same year with the Mit Afifi variety at Hartsville, S. C., and at Houston and Brownsville, Tex.; with the Jannovitch variety at Denison, Tex., and with the Ashmuni variety at Danville, Ga., and Waco, Tex.

REPORTS OF EXPERTS ON THE FIBER PRODUCED IN 1902.

Fourteen samples, representing each Egyptian variety from each locality where it was grown in 1902, were submitted to seven American cotton buyers. The Jannovitch, grown at Calexico, Cal. (about

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[a] In Circular 26 of the Division of Botany, U. S. Department of Agriculture, 1900, Mr. Dewey describes the results of experiments with Egyptian cotton in the United States up to that time. In these earlier experiments perhaps the most promising results were obtained by Mr. W. H. Wentworth at Floresville, near San Antonio, Tex., indicating that success is to be looked for west of the main cotton belt.

[b] Doctor Webber has described his experiments in Proceedings of the Seventh Annual Convention of the Southern Cotton Spinners' Association, pp. 127–138, 1903.

60 miles west of Yuma), was highly commended by all of these experts. Two of them rated it highest among the fourteen samples, while four rated it as equal to any. Only one expert gave the preference to another of the fourteen samples.

The same series of samples was sent to Mr. William Getty, buyer of cotton at Alexandria, Egypt, for a firm at Providence, R. I.[a] His report showed the Jannovitch fiber produced at Calexico to be the best of the lot. Mr. Getty said of it: "Length of fiber, quite 2 inches;[b] strength very good; uniformity, good; very fine; rich in color; spinning quality very high; valuation at present market conditions [August 4, 1903], 21 to 22 cents per pound; is especially adapted for sewing cotton and for same purpose as Sea Island; is equal to the best Jannovitch in all respects and could not be improved upon."

The Lowell Textile School, to which eleven of these samples were also submitted, reported through Mr. O. L. Humphrey, head instructor in the cotton yarn department, on the Jannovitch grown at Calexico in the following terms: "Staple fully 1½ inches. Fiber very strong, fine, and even. Very small amount of unripe or short fiber. Cotton clean and in fine condition. Use for 60's carded, 70's and 80's combed."[c] These are higher numbers of yarns than were furnished by any of the other samples and indicate a fiber of superior fineness. Mr. Humphrey adds, "An examination of the various samples would indicate that of the three varieties Jannovitch was decidedly the best."

Manufacturing tests of the eleven samples were made with great care by the Lowell Textile School.[d] The cotton was "picked" (i. e., loosened in preparation for combing), combed, roved, and spun into yarn with the same degree of care and following the same methods used by manufacturers who handle corresponding grades of imported Egyptian cotton. Exact determinations were made of the amount of waste occurring during each process and of the strength of the yarn produced.

The waste includes moisture lost during the different manufacturing processes, dust, fragments of leaves, of bolls, and of seeds, and short fiber. It is stated in percentages of the weights of the original samples. The total waste from the sample of Jannovitch grown at Calexico amounted to 23 per cent and from the sample of the same variety grown at Yuma to 26 per cent. The average for the eleven samples grown in the United States was 26 per cent, while a sample of imported Mit Afifi [a] secured from a New England mill, which uses large quantities of this cotton, showed 27 per cent of total waste. The normal waste from imported cotton of this variety handled in the same way is estimated by Mr. Humphrey at about 24.2 per cent.

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[a] Mr. Getty, who had had thirty years' experience in the cotton business in Egypt, also referred the samples to several experts in Liverpool, who confirmed his opinion.

[b] This was a higher rating as to length than was given by any of the American experts, who placed the length at 1½ or 1⅝ inches.

[c] Long-staple cottons are usually combed as a preliminary to spinning, while short-staple cottons are generally carded.

[d] The Lowell Textile School also submitted the samples to Mr. F. S. Kerrigan, expert of a manufacturing company at Lowell, Mass., who examined them independently and whose report corroborated Mr. Humphrey's to a remarkable degree.

The manufacturing tests gave the following results, according to Mr. Humphrey's report:

> The running of the samples in the roving processes was excellent. * * * The roving made was exceptionally strong and even. * * * The samples of "Jannovitch" [from Calexico, Cal.; Yuma, Ariz., and Denison, Tex.] ran in the spinning almost without a break and showed in this process remarkable strength. In order to compare the strength of the warp yarns of the various samples, 40 skeins of 120 yards each of every sample were reeled, the ends tied, broken, and weighed. The skein breaking was done on a power-driven yarn tester giving uniform speed.

The strength is stated in terms of the average weight in pounds that was required to break each skein of each sample. The samples of Jannovitch grown at Calexico and at Yuma proved to be decidedly the strongest of the eleven samples, 66 pounds having been the average weight required to break the former, and 74 pounds the latter, while the general average for the eleven American-grown samples was 55.5 pounds. For the sample of imported Egyptian the average breaking strength was 45.5 pounds. Taking the strength of Draper's Standard Warp as 100, the Jannovitch cotton grown at Calexico had in comparison a strength value of 146.5 and that grown at Yuma of 164.5, while the imported Mit Afifi had a strength value of only 101, which was surpassed by nearly all the American samples. This difference is explained by Mr. Humphrey as "largely due in many cases to the greater length of staple, although the strength and spinning qualities of the staple are unquestionably instrumental in producing this result."

The samples of Jannovitch grown at Calexico and Yuma were adversely criticised by Mr. Humphrey in respect to only one characteristic, i. e., the presence of a considerable amount of "nep" in the finished yarns. Mr. Humphrey says, however, that they "will compare fairly well in this respect with the bulk of the Egyptian yarn of this number which is being manufactured at the present time."

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[a] Mr. Humphrey says of this sample, "This variety (grade and length) is, however, considered a fair average Egyptian cotton and one that is very largely and generally used in this country."

Mr. Humphrey concludes his report as follows:

> An examination of these American-grown Egyptian cottons and an inspection of the table of results as here given shows them to be, as a rule, long stapled, unusually strong, uniform and satisfactory in color, clean, and possessed of good spinning qualities. The per cent of short fibers compares very favorably with that of the imported article, but the amount of unripe fiber in some of the samples is excessive. This may perhaps be due to the fact that the cotton was raised in limited amounts, and in order to secure the greatest possible quantity of each, the picking was more thorough and included a larger per cent of the contents of the unripe or partially ripe bolls than would have, under ordinary conditions, been gathered. From the results of these tests we can naturally infer that there is a flattering future for American-grown Egyptian cotton, provided the standards can be maintained. This stock admits of the production of much finer numbers and better qualities of yarn than could be made from Upland, Texas, or Gulf cotton, and is inferior only to Sea Island cotton.

RESULTS OF ACCLIMATIZATION AND SELECTION IN THE SOUTHWEST.

In 1902 numerous selections were made in the test plats of the Mit Afifi and Jannovitch varieties at Barstow, Tex.; Carlsbad, N. Mex.; Yuma, Ariz., and Calexico, Cal. These selections were planted in 1903 at the same four localities on the "plant to the row" system. In addition a test plat of the Abbasi variety was grown at Carlsbad. In 1904 the selections of Mit Afifi and Jannovitch made in 1903 were planted only at Carlsbad and Yuma. In 1905 the selections made in 1904 were planted at the same two localities, but those at Yuma were lost soon after planting, as a result of the unprecedentedly high spring flood of the Colorado River. A large number of selections were made at Carlsbad, however, and with these the work has since been continued at Yuma.[a]

The Abbasi variety was soon discarded because it too nearly resembles Sea Island cotton, with which it would undoubtedly compete in American markets. It was desired from the outset to secure a type of cotton for culture in the Southwest that would be distinctive of that region as compared with other cotton-growing sections in the United States. The best means of attaining this end appeared to be by acclimatizing the very distinct Mit Afifi and Jannovitch varieties, especially the former.

Numerous selections of Mit Afifi have been carried through five generations and have fully retained the distinguishing characters of the variety. Through a series of accidents the original selections from imported seed of the Jannovitch variety were lost, but certain selections from the more or less mixed seed of the Mit Afifi variety with which the experiments were begun have so nearly approximated the characters of Jannovitch that there seems to be no good reason for making new selections from imported seed of the latter.

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[a] In 1904 and 1905 the selections were made by Mr. L. L. Harter.

Throughout the course of the experiments the plants have been grown under irrigation on the best land and with the best care as to irrigation, cultivation, etc., that circumstances admitted. It was not until last year, however, when the work was carried on in association with the Office of Western Agricultural Extension Investigations of this Bureau, that it became possible to raise the cotton under favorable conditions as regards cultivation and irrigation. Previous to 1907 these selections were exposed to so many vicissitudes—drought, alkali soils, inadequate cultivation, etc.—that there is good reason to believe that they are exceptionally hardy and well adapted to growing under conditions below the optimum for cotton culture in the region.

CHARACTERS OF THE PLANTS.

During the earlier years of the experiments it was extremely problematical whether Egyptian cotton would adapt itself to conditions in the Southwest. The plants made a very vigorous growth, but produced relatively few bolls, as is shown in Plate II, figure 1. These bolls matured so late in the season that many of them were cut off by frost before they opened. The opening of such bolls as ripened was generally very unsatisfactory, the valves of the locks remaining half erect instead of spreading horizontally, so that in picking the fiber had to be pulled out between the points.

Each year, however, a marked improvement in yield, earliness, and the degree of opening of the bolls manifested itself. In 1906, whether through acclimatization or selection or a combination of the two agencies, such a great improvement had been attained that there seemed little occasion for further anxiety on these scores. The Egyptian plants were still, it is true, much larger and ripened their fiber later than those of most Upland varieties grown under similar conditions, and their bolls remained small and pointed (Plate IV). All these, however, are characters inherent in the species of cotton (*Gossypium barbadense*) to which the Egyptian and Sea Island varieties belong, as distinguished from that which includes the American Upland varieties (*Gossypium hirsutum*). No amount of selection can be expected to entirely remove them. But, as compared with the performance of the plants in previous seasons, there had been a marked reduction in height and in the development of sterile branches (Plate III). The relative number of bolls produced was much larger and the fiber ripened much earlier than in any previous year. Furthermore, the bolls opened out flat, so that the cotton hung as loose as from bolls of Upland varieties.

In 1907 these characteristics had become practically uniform over the entire field (Plate I, frontispiece), not only in the selection rows but in the one-fourth-acre plats that were planted with seed from second-select plants of 1906 for yield tests and for experiments with different irrigation and cultivation methods. Before the middle of September the cotton was ready for the first picking. It was therefore at least a month earlier than was the case during the first three years of the experiments. The satisfactory opening of the bolls is shown in Plate IV, while Plate II, figure 2, illustrates the manner in which the ripe cotton hung loosely in the open bolls. Careful records of the time consumed in picking at Yuma in 1907 showed that it required only about one and one-half times as long to pick 100 pounds of seed cotton of the Mit Afifi Egyptian as of large-bolled Upland varieties, such as Triumph and Rogers Big Boll.

YIELD TESTS.

Yield tests of two Egyptian and five American Upland varieties of cotton were made at Yuma in 1907 on plats ranging in size from one-tenth to one-sixth acre. The results in pounds of seed cotton, calculated on the basis of 1 acre, are given in the following table:

TABLE VI.—*Results of yield tests of cotton varieties at Yuma, Ariz., in 1907, in pounds of seed cotton and estimated pounds of lint produced per acre.*

Variety.	Pounds of seed cotton per acre.		Estimated percentage of lint.	Estimated total yield of lint.
	Ripened before Dec. 1.[a]	Total yield.		
				Pounds.
Mit Afifi (Egyptian)	2,880	3,300	[b] 30	990
Jannovitch (Egyptian)	1,851	2,228	30	668
Rogers Big Boll (short-staple Upland)	2,897	2,975	34	1,011
Triumph (short-staple Upland)	2,571	2,660	37	984
Sunflower (long-staple Upland)	1,950	2,235	30	670
Southern Hope (long-staple Upland)	2,572	3,052	30	915
Columbia (long-staple Upland)	2,101	2,456	30	737

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[a] The amounts of seed cotton that ripened before December 1 are inserted because the autumn of 1907 was unusually warm, and it is possible that the figures in this column more nearly represent the yields that can normally be expected than do the total yields in 1907. The amounts that ripened after December 1 were estimated by dividing the total amount of seed cotton secured at the last picking by the number of days that had elapsed between this and the preceding picking and multiplying the result by the number of days between December 1 and the date of the last picking. The results are necessarily only approximate, since the amount of cotton that ripened daily must have decreased toward the end of the season.

[b] A 50-pound sample of seed cotton of this lot was very carefully ginned on a roller gin and gave 33.5 per cent lint. On the other hand, a 200-pound sample yielded only 29.1 per cent. Thirty per cent would therefore appear to be a conservative estimate. Since in Egypt the Mit Afifi variety is said to give from 33 to 35 per cent of lint, there is every reason to believe that the percentage of lint of this variety in the Southwest can be materially improved over that obtained in 1907 at Yuma. The estimated percentage of lint for the other varieties in Table VI are based upon the average performance of these varieties in other localities.

Notwithstanding the fact that in two of the Upland varieties the percentage of lint is considerably higher than in Egyptian varieties, only one of them surpassed the Mit Afifi in productiveness, and that to but an inconsiderable extent. The lower yield of the Jannovitch Egyptian as compared with the Mit Afifi is doubtless partly due to the fact that the Jannovitch plat in 1907 was planted with seed from plants grown in 1906 from an imported stock, while the stock of Mit Afifi had had the advantage of five years' acclimatization in the Southwest.

QUALITY OF THE FIBER.

During the earlier years of the experiment it seemed so essential to concentrate every effort upon combating sterility, late ripening, and imperfect opening of the bolls that in making the selections only secondary weight could be placed upon the quality of the fiber.

The Jannovitch variety, nevertheless, produced an excellent grade of fiber from the start. This was probably due to the recent origin of this variety, which had not had time to deteriorate seriously since it left the hands of the breeder. As has been stated, the fiber produced by this variety grown from imported seed at Calexico, Cal., and Yuma, Ariz., in 1902 was given a high rating by the Lowell Textile School and by expert cotton buyers in the United States and in Egypt. The Jannovitch variety was again grown from imported seed at Yuma in 1906, and the seed thus obtained was used in planting the yield-test plat of this variety in 1907. In this case also the American-grown product compared far more favorably with the average of the variety in Egypt than did the Mit Afifi variety during the first two or three years after it was introduced.

The fiber produced by the Mit Afifi variety during the earlier years of the experiments in the Southwest was of decidedly inferior quality. As compared with the best grades produced in Egypt, the lint was relatively short, in hardly any case reaching a full $1\frac{3}{8}$ inches. It was coarse and woolly and of a dead appearance, lacking the fine luster that is one of the most attractive qualities of high-grade Egyptian cotton. Very few plants showed even an approximation to the great strength that is one of the leading and most valuable characteristics of this type of cotton. In color also it left much to be desired, the brown tint being either nearly wanting or so irregularly distributed as to give the cotton a blotched appearance, as though artificially discolored.[a]

In 1905, the tendencies to sterility, late ripening, and imperfect opening of the bolls in the Mit Afifi variety having largely disappeared, it became possible to focus attention upon the characters of the fiber. As a result, in 1906 the fiber showed a marked improvement in all of its characters, and this was true to a still greater extent in 1907. In the latter year selection was made so rigorous that the best individual plant of 1903 would have failed to pass muster. In the 1 acre of breeding rows planted with seed from the first-select plants of 1906, the length averaged practically 1½ inches. The thirty-eight first selections of individual plants made in 1907 had fiber of an average length of 1$\frac{9}{16}$ inches, as compared with an average of 1½ inches for the thirty-one first selections made in 1906. In other words, a gain of 4 per cent in length had been made in one generation. This is probably the maximum length to which the Mit Afifi type of Egyptian cotton should be bred to meet the demands of the existing market.

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[a] From the fact that the results obtained during the first year or two of the experiments were much more satisfactory with the Jannovitch than with the Mit Afifi variety, it might be inferred that when first imported the former is better adapted than the latter to southwestern conditions. More likely, however, the Mit Afifi seed originally imported was of inferior quality. As heretofore stated, this variety is deteriorating in Egypt and becoming mixed with inferior sorts except where it is kept up by careful selection.

In all other characters—covering of the seed, uniformity of length on the same seed and in different bolls on the same plant, strength, color, fineness, and luster—the advance was so striking that it was in some cases difficult to realize that the plant of 1907 was only in the fifth generation of descent from its progenitor of 1902 (Pl. V).[a] No one characteristic showed more gratifying progress than that of strength. While in 1903 the plant producing fiber that could not be broken easily between the fingers was a rare exception, in 1907 it was the general rule. Fiber of great fineness, soft and silky to the touch, was also the rule. Brown color characterized the fiber on the great majority of the plants, and was almost as general and pronounced as in any field seen in Egypt by one of the writers. In plants which preserved the Mit Afifi type the brown tint was conspicuous, especially when a mass of the fiber was examined, although much lighter than in the red-brown Peruvian and Nanking cottons. In plants that showed an approximation to the Jannovitch type, the fiber was of a delicate cream color, appearing almost white when compared with Mit Afifi, but showing clearly the brown tint when matched with American Upland fiber. The Jannovitch type was furthermore remarkable for the silky luster of the fiber.

Strength tests.—Careful tests of the strength of several samples of Egyptian cotton grown at Yuma in 1907 were made by the Office of Fiber Investigations of the Bureau of Plant Industry. The tests were made on a special fiber-testing machine. The samples submitted were as follows: No. 1, Mit Afifi, from a plat which received eight irrigations after planting; No. 2, Mit Afifi, from a plat which received only one irrigation after planting; No. 3, Mit Afifi, from a plat which received three irrigations after planting; No. 4, the average of the first picking from seven individual selected plants of

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[a] During each year of the experiments combed-out seeds of every selection have been preserved as a record of the progress made in breeding.

Mit Afifi in the breeding rows which had received four irrigations after planting; No. 5, the average of the later pickings from the same seven selections. Jannovitch from the yield-test plat, which was irrigated twice after planting, was also tested. The Mit Afifi had in every case been grown five years in the Southwest, while the Jannovitch was from that grown at Yuma in 1906 from newly imported seed.

In order to permit a comparison of the strength of the Arizona-grown Egyptian samples described above with that of cotton of other varieties and from other sources, the Office of Fiber Investigations also furnished the results of a series of tests made by Mr. Frederick J. Tyler upon different Upland and Sea Island varieties, as well as upon three varieties of Egyptian cotton. All of these were grown by Mr. Tyler without irrigation at Waco and Terrell, Tex., with the exception of the two samples of Southern Hope (long-staple Upland). The latter were produced under irrigation at Yuma, Ariz., in 1907.

The results as stated in the following table represent the average of the weights in grams required to break each of twenty individual fibers from each sample:

TABLE VII.—*Breaking strength of samples of Egyptian and other cottons grown under irrigation in Arizona and without irrigation in Central Texas.*

Type of cotton.	Variety.	Where grown.	Number of irrigations.	Breaking strength.
				Grams.
Egyptian	Mit Afifi, No. 1	Arizona	8	4.6
	Mit Afifi, No. 2	Arizona	1	6.5
	Mit Afifi, No. 3	Arizona	3	6.4
	Mit Afifi, No. 4	Arizona	4	5.9
	Mit Afifi, No. 5	Arizona	4	6.2
	Mit Afifi	Texas	None.	4.5
	Jannovitch	Arizona	2	6.4
	Jannovitch	Texas	None.	4.0
	Ashmuni	Texas	None.	5.5
Upland long-staple	Allen	Texas	None.	3.5
	Boozer	Texas	None.	3.4
	Florodora	Texas	None.	3.1
	Griffin	Texas	None.	3.5
	Peeler	Texas	None.	4.1
	Sunflower	Texas	None.	3.4
	Southern Hope, No. 1	Arizona	8	6.0
	Southern Hope, No. 2	Arizona	1	5.0
Upland short-staple	Culpepper	Texas	None.	5.1
	Cook Improved	Texas	None.	7.0
	Drake	Texas	None.	4.5
	Excelsior	Texas	None.	5.3
	Jones Improved	Texas	None.	5.2
	King	Texas	None.	4.8
	Mortgage Lifter	Texas	None.	5.9
	Russell	Texas	None.	7.5
	Truitt	Texas	None.	6.0

In regard to the Egyptian cottons grown under irrigation at Yuma it is interesting to note the relative weakness of the fiber in Mit Afifi sample No. 1, from a plat that was excessively irrigated, as compared with samples 2 and 3, from plats that received only one and three irrigations, respectively, after planting. The selections (samples 4 and 5) were irrigated four times after the seed was put in. In the case of the selections an unexpected result is the greater strength shown by the later pickings (sample 5) as compared with the first pickings (sample 4) from the same individual plants. In Egypt, on the other hand, the fiber from the first pickings is reputed to be generally stronger than that which is picked later in the season.

It will be observed that the long-staple Upland or Peeler varieties are generally very inferior in strength to the short-staple Uplands. A notable exception is the Southern Hope, which was grown under irrigation at Yuma. It is rather remarkable that in this case sample No. 1, which received eight irrigations after planting, is decidedly stronger than sample No. 2, which was watered only once after the seed was put in. On the other hand, the Mit Afifi Egyptian, which received eight irrigations at Yuma (sample No. 1 in Table VII), was decidedly inferior in strength to that which was irrigated only one to four times (samples 2 to 5). The Mit Afifi and Jannovitch Egyptian varieties, grown under rainfall in central Texas from imported seed, appear to be deficient in strength as compared with the same varieties under irrigation in Arizona.

From the manufacturer's point of view, tests that are based upon the breaking point of individual fibers are not alone satisfactory indicators of the strength of a given sample of cotton. They should be supplemented by tests of the breaking strength of the thread, which depends not only upon the strength but the length and fineness of the individual fiber, the last character determining the number of fibers which can be spun into a thread of given diameter. But when the great fineness and the satisfactory length, as well as the great strength of the individual fibers of the Egyptian cotton produced in Arizona in 1907 are taken into consideration, we can be reasonably certain that they will furnish a very strong thread.[a]

Comparison of the fiber from different pickings.—In view of the belief prevailing in Egypt that fiber from the first picking is decidedly superior to that from the second and third, the products of the first and of the later pickings from some of the best selected plants of the Mit Afifi variety at Yuma in 1907 were carefully compared. In point of strength, as has been noted, the fiber from the later pickings, which were taken together, was found to be uniformly somewhat superior to that from the first, but in the other characters no pronounced difference was observed, except that in two or three cases the length was slightly inferior in the later pickings. In color the later pickings were in all cases equal to the first.

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[a] The results of the strength tests of yarns spun from the Jannovitch cotton grown at Calexico and Yuma in 1902 support this belief.

OPINIONS OF EXPERTS ON THE FIBER PRODUCED IN 1907.

Small samples of the acclimatized Arizona-grown Egyptian cotton produced in 1907 were submitted to 22 American buyers and manufacturers of this type of cotton, of whom 18 reported their opinions of its quality and 11 furnished estimates of its value at current market prices. The prices varied considerably, ranging from 18 to 26 cents a pound, the average of all the estimates obtained being 20.6 cents. At the time when these estimates were furnished (February 15 to March 7, 1908) American Middling Upland cotton was selling on the Boston market for 12 to 12½ cents a pound, and imported Egyptian cotton for 12 to 15½ cents ("low grades"), 14 to 18 cents ("current grades"), 16½ to 19 cents ("good grades"), and 17½ to 21 cents ("high grades").[a] The Arizona-grown fiber would therefore be classed with the high grades of imported Egyptian cotton.

The length of the Arizona-grown fiber was placed at slightly less than 1½ inches (average of 10 estimates)—hence superior to most grades of Mit Afifi but inferior to the best grades of Jannovitch. As to evenness or uniformity of length, all but 1 out of 11 opinions were very favorable, 2 of the experts pronouncing the Arizona product superior in this respect to imported Jannovitch.

In respect to fineness, the consensus of opinion appeared to be that the fiber is somewhat inferior to Jannovitch but superior to Mit Afifi. In regard to the strength of the Arizona-grown fiber, all the reports were satisfactory, most of the experts considering it equal to that of imported Jannovitch, while one manufacturer reported it as "rather better." The color was pronounced to be lighter than the best grades of Mit Afifi, but darker than Jannovitch. Only 1 out of the 14 experts who rendered an opinion on the color of the samples criticised it as "uneven." The luster of the Arizona-grown fiber was generally regarded as somewhat inferior to that of imported Egyptian. The "cling," or "barb," an important quality in making strong thread, was commented upon favorably by the two manufacturers who mentioned this point. Opinions differed somewhat as to the freedom of the samples from waste, the consensus being apparently that in this respect the Arizona cotton was similar to all but the best grades of imported Egyptian. As to absence of "nep," the opinions were on the whole decidedly favorable.

The manufacturers and buyers who examined the Arizona-grown fiber were practically unanimous in stating that it could be satisfactorily substituted for corresponding grades of imported Egyptian cotton.

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[a] Prices quoted on the Boston market as given in the Commercial Bulletin of Boston, February 15, 22, and 29, and March 7, 1908.

It is evident from the reports received that the experts differed as to the variety of cotton represented by the samples, some making their comparison with Mit Afifi and some with Jannovitch. A summing up of the opinions received indicates that the Arizona cotton is exactly intermediate between these two varieties in almost every character. This is not surprising, since the samples were taken from the yield-test plats of 1907, which were grown from seed obtained from the "second-select" plants in the breeding rows of 1906 and mixed together. As has already been pointed out, the seed with which the breeding experiments were commenced at Yuma, although imported under the name of Mit Afifi, produced many plants which approximated the Jannovitch variety in the quality of their fiber. During the last two years superior plants typical of each of these varieties have been selected, and it is expected that in a short time there will be available a supply of pure seed of both Mit Afifi and Jannovitch Egyptian cottons thoroughly adapted to the climate of the Colorado River region.

TYPES PRODUCED.

To sum up, two well-marked types of Egyptian cotton, both developed from mixed seed that was imported under the name of Mit Afifi, have been carried through five generations of acclimatization and selection and have now reached a high degree of uniformity and adaptability to conditions in the southwestern United States. These are (1) the Mit Afifi type, having fiber that averages 1½ inches in length, very strong, soft, and fine, decidedly crinkly, and of a light-brown color; (2) the Jannovitch type, with fiber averaging 1⅝ inches in length, smoother, silkier, and more lustrous than the Mit Afifi, and of a very delicate cream color. The latter type may be regarded as almost intermediate in most of its characters between Mit Afifi Egyptian on the one hand and Sea Island on the other.

IRRIGATION EXPERIMENTS.

In order to determine the effect upon the yield and quality of the fiber produced by different amounts of irrigation water applied at different intervals, a series of plats was planted to Mit Afifi Egyptian cotton at Yuma in 1907.

The soil of these plats was fairly uniform, being a sandy loam on the surface with rather open sand in the subsoil. This land had not been in crop for about ten months previous to planting the cotton and had not been irrigated, so that it was very dry. It was plowed and prepared for planting early in March, 1907, was thoroughly irrigated by flooding on March 23, and the cotton was planted five days later. No facilities were at hand for measuring the amount of water applied at each irrigation, but the effort was always made to irrigate each of the plats for about the same length of time with the same head of water. In each case the land was cultivated with either a 5-shovel or a harrow-tooth cultivator as soon as possible after irrigation, although in the case of plat 5 cultivation was not possible after the later irrigations, owing to the large size of the mature plants.

The table which follows gives the dates on which each plat was irrigated from the time the cotton was planted until the last picking was made:

TABLE VIII.—*Numbers and dates of waterings given irrigation experiment plats at Yuma in 1907.*

Dates of irrigations.	Plat 1.	Plat 2.	Plat 3.	Plat 4.	Plat 5.
May 9	X		X	X	X
May 25		X			X
July 3					X
July 15		X			X
July 25					X
August 6					X
August 24			X		X
September 12		X		X	X
Total number	1	3	2	2	8

In Table IX are given the dates of each picking on each plat, the number of pounds of seed cotton (calculated on the basis of 1 acre) secured at each picking, and the percentage of the entire yield of each plat represented by the corresponding picking and those previous to it.

TABLE IX.—*Yields of seed cotton (in pounds per acre and percentages of the total yield) secured on the irrigation experiment plats at Yuma in 1907.*[a]

Dates of pickings.	Plat 1.		Plat 2.		Plat 3.		Plat 4.		Plat 5.	
	Seed cotton.	Per cent of total.	Seed cotton.	Per cent of total.	Seed cotton.	Per cent of total.	Seed cotton.	Per cent of total.	Seed cotton.	Per cent of total.
	Lbs.		*Lbs.*		*Lbs.*		*Lbs.*		*Lbs.*	
September 19			688	20.7						
September 22							664	31.9		
September 23					470	17.6				
September 24	451	30.6								
October 9									332	12.2
October 11			567	37.7						
October 19	291	50.3								
October 22					729	44.9	448	53.4		
October 23									535	31.8
October 25			567	54.8						
October 28	402	77.6								
November 5					584	66.7			391	46.3
November 6							303	68.1		
November 12			706	76						
November 22									772	74.7
December 20	330	100			891	100	664	100	693	100
December 23			802	100						
Total	1,474		3,330		2,674		2,079		2,723	

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[a] In the columns headed "Seed cotton" are given the pounds per acre obtained on each plat at each picking. In the columns headed "Per cent of total" are given the accumulated percentages of the total yield from each plat that had been secured up to the date of the respective picking.

It will also be interesting, as a measure of the degree to which ripening was hastened or retarded by the treatment given the different plats, to note the average number of large but green and still unopened bolls per plant remaining after the last picking. These were as follows: Plat 1, 0; plat 2, 4; plat 3, 21; plat 4, 25; plat 5, 23.

These plats were not planted until March 28, 1907, although if the condition of the weather alone had governed the date of planting the seed could have been put in several weeks earlier. Plat 2 was planted as a yield-test plat, but the treatment it received produced such excellent results that it is included here for comparison.

On plat 1, which was irrigated only once after planting, ripening was hastened, half of the total product having been harvested at the first two pickings. While the yield from this plat was light compared with that from the others, yet it amounted to nearly one bale per acre. The light irrigation that was given allowed the soil to remain so dry during the greater part of the summer that Bermuda grass could make little growth.

Plat 2 was irrigated three times and plats 3 and 4 twice after planting. The results from these three plats show that the longer the second irrigation was postponed the smaller was the total yield. Plat 2, which received its second irrigation six weeks earlier than plat 3 and nearly nine weeks earlier than plat 4, yielded much more heavily than the others. The first four pickings were earlier on this plat than on any of the others. It will be noted that the first irrigation was given two weeks later on plat 2 than on plats 3 and 4, which may also have had something to do with the heavier yield on plat 2. On this plat the growth induced by the irrigation on July 15, 1907, had nearly all matured when the last picking was made. The irrigation which this plat received on September 12 did not induce as much new growth as did the last irrigation given plats 3 and 4. The late growth on plats 3 and 4 did not fully mature its bolls before a frost occurred, as is indicated by the large number of green bolls remaining after the last picking was made.

Plat 5, which was irrigated eight times after planting, ripened its fiber later than any of the others, as is well shown by the fact that the percentage of the total yield represented by the first two pickings was much smaller than in the other plats, and by the high average number of unripe bolls that remained on the plants after the last picking. The first picking on this plat, although taken sixteen days later than on any of the others, yielded only 12 per cent of the total product. Notwithstanding, the total yield from this plat was second only to that from plat 2, there having been no killing frost in 1907 until the middle of December. In ordinary years cotton irrigated thus heavily would be in danger of a reduction of yield through failure of many of the bolls to ripen before a severe frost occurs. The growth on plat 5 was very rank and picking was correspondingly difficult. The fiber from this plat was only about 70 per cent as strong as that from plats 1 and 2, which received, respectively, only one and three irrigations after planting. In other characters of the fiber no difference could be detected except that the color was slightly less pronounced on the excessively irrigated plat.

It would be unsafe to generalize concerning the results of experiments conducted during only one season, especially as the date of the first killing frost was unusually late in 1907. It may be said, however, that on sandy loam soils in the Colorado River region heavy yields of Egyptian cotton are possible with very moderate irrigation provided the soil is thoroughly cultivated after each watering and that apparently little benefit is obtained from the application of water after the 1st of September. Further experiments are necessary to determine accurately the amount of water that will produce the best results on the various types of soils occurring in the region.

SUGGESTIONS AS TO CULTURAL METHODS.

Cotton has been so little grown under irrigation in the United States that much remains to be learned about producing the crop under these conditions. The following suggestions are based partly upon the limited experience that has so far been obtained in the Southwest and partly upon our knowledge of the methods followed in Egypt. As has already been pointed out, however, the Egyptian system of growing cotton can not be closely followed in the United States, owing to the great difference in the labor conditions of the two countries.

IRRIGATION.

The principal difference between cotton culture in the arid region of the United States and in the South Atlantic and Gulf States is the almost perfect regulation of the water supply that is possible under irrigation. This enables the farmer to control the condition of the soil, so that it need never be wet at times when plowing, planting, cultivating, picking, and other cultural operations should be performed. This and the almost total absence of rain during the growing season make it much easier to plan and carry out the farm work. The expense of irrigating is more than compensated for by these advantages and by the fact that there is little danger of loss or damage from rainy weather.

In all irrigated districts where water is abundant there is a tendency to irrigate too frequently and to cultivate too little. The practice of excessive irrigation instead of cultivation is always objectionable, as it tends to leach the soil of its plant food, injures its mechanical condition, and encourages the growth of weeds. In cotton culture it has the further disadvantage of causing an overproduction of wood and a retarded ripening of the bolls. The conservation of the soil moisture by thorough tillage after each irrigation is in every way a more economical practice.

The first essential to successful irrigation is thorough leveling of the land. For a cultivated crop like cotton a fall of 2 inches to every 600 feet is sufficient in most soils. The frequency with which irrigation should be given depends largely upon the character of the soil. Heavy loams and clays have of course a high water-holding capacity and do not need to be irrigated as often as sandy loams. On heavy land, if well tilled, one or two irrigations after planting are sufficient to mature a crop of cotton properly, while on the very light soils three to five irrigations may be required.[a]

Irrigation by flooding requires the least labor and gives the most satisfactory results. In Egypt, where an abundance of very cheap labor can be had, furrow irrigation is practiced, but in this country the cost of labor would be almost prohibitive, even if it were found otherwise desirable to adopt the furrow system. The quantity of water given cotton at any one irrigation should be sufficient to insure penetration of the soil to a considerable depth. In most cases flooding to a depth of about 6 inches suffices.

Cotton is a comparatively drought-resistant plant, which is probably at least partly due to its deep rooting habit. It has been found that in the rather light soils of the Yuma Valley, if good cultivation is given, the roots of this plant will penetrate to a depth of 6 to 8 feet. Hence, cotton requires less frequent irrigation than shallow-rooted crops. It has been observed, however, that the Egyptian varieties show the effect of drought sooner than Upland cottons.

Since the amount of water that will produce the best results and the frequency with which irrigations should be given depend largely upon the character of the soil and the thoroughness of the tillage, it is difficult to give precise directions on these points. In general, cotton should be irrigated as little as possible after it has begun flowering. Heavy irrigation in the latter part of the summer, especially during very dry, hot weather, results in a dropping of the squares[b] and young bolls. It is also likely to stimulate a late growth, so that there is danger that many bolls will be caught by frost before reaching maturity.

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[a] In Egypt, as has already been noted, 10 irrigations are ordinarily given between the date of planting and that of the first picking. It must be remembered, however, that as cotton is planted in Egypt there are 10 times as many plants to the acre as in the experiments at Yuma. If closer planting is practiced in the Southwest, more water will probably be required.

[b] The term "square" is applied to the unopened bud of the cotton flower with its inclosing bracts.

PREPARATION OF THE LAND.

Thorough preparation of the soil is necessary to insure perfect germination. If no winter or green-manure crops are grown on the land it should be plowed in the fall, so as to expose the greatest possible amount of surface to the air during the winter months. Plowing to a depth of 6 to 10 inches is advisable in all types of soil, as it encourages the development of a deep root system. The work should be done when the surface soil is not dry and baked, otherwise difficulty will be experienced in obtaining a mellow, well-pulverized seed bed.

If a winter crop is grown it should be removed and the ground plowed as early in the spring as possible. It is essential to turn under green-manure crops several weeks before planting cotton, in order that they may decompose somewhat before the seed is put in. Just before giving the first irrigation in the spring the land should be well harrowed and gone over once with a leveling drag, in order to remove the inequalities caused by plowing. In the latter part of February or early in March the land should be thoroughly flooded, so that every part of it is covered to a depth of 3 or 4 inches. Unless this is done germination will not be uniform and the stand will be imperfect. As soon after this first irrigation as possible the land should be double-disked and then worked over with a smoothing harrow. On some soils it may be necessary to follow the smoothing harrow with the leveling drag. These operations, if carried out at the proper time, will insure a loose, mellow, and moist seed bed over the entire field. Under these conditions, if good seed is used, germination will take place in five or six days and a uniform stand will be obtained.

PLANTING.

In the Southwest cotton should be planted early. Without exception the plantings made at Yuma between March 15 and March 30 gave larger returns than later plantings of the same varieties. Seed that was put in early produced plants that branched well near the ground and made a more determinate growth than those that came from seed planted near the end of April. The latter came up readily and grew rapidly, but the plants were spindling, the yield light, and the crop late in maturing. Periods of cold weather are likely to follow early planting and to retard the upward growth of the young plants, but during these periods a good root system is being developed and when warm weather comes on later such plants make a more satisfactory growth than those from later plantings. Of course, the proper time for planting in any locality will depend largely upon the normal date of the last frost in the spring. Cotton seed should be put in as soon as the danger of killing frost is past. In the Colorado River region it is probable that in ordinary seasons planting can be done to advantage between March 1 and March 15, and in the Salt and Gila valleys between March 15 and March 31.

The proper distance for planting Egyptian cotton in the Southwest varies somewhat according to the nature of the soil, but it is always much greater than that used in Egypt for the same varieties or in the southern United States for Upland varieties. Experiments in the South indicate that the yield increases as the space assigned to each plant approaches a perfect square. Egyptian varieties, however, grow more rankly and require more space than any Upland variety. Moreover the weight of the bolls at the ends of the long branches bears them almost to the ground and makes the last cultural operations and the picking so difficult that it is advisable to have the rows much farther apart than the hills. A distance of 6 feet between the rows, with the plants 3 feet apart in the row, which gives each plant 18 square feet, produced very satisfactory results at Yuma during the past season. A yield at the rate of 990 pounds of fiber per acre was obtained from the Mit Afifi variety planted at this distance, which requires only 5 or 6 pounds of seed per acre. It is possible that very close planting in the row may tend to check the luxuriance of growth of this type of cotton without decreasing the yield.

As the acclimatization of Egyptian cotton progresses, the proper planting distance can doubtless be very materially decreased. The average distance in Egypt for the same varieties of cotton is 32 inches between the rows, with the hills 16 inches apart in the row and with two plants to the hill. These distances allow each plant 1.8 square feet of ground space, or just one-tenth that given at Yuma. With this planting distance there would be 24,000 plants per acre or ten times the number present when the distance is that adopted last year at Yuma. The average amount of seed used per acre in Egypt is 45 pounds. The great difference between the planting distance generally used in Egypt and that which has so far given the best results at Yuma indicates that much allowance must be made for the effect of further acclimatization in reducing the size of the plants. Moreover, additional experiments are necessary in order to determine the most profitable planting distance for Egyptian cotton on different types of soil in the Southwest.[a]

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[a] It is proposed to test different planting distances at Yuma during the season of 1908.

If the soil has been well prepared and is free from Bermuda grass, the ordinary one-horse cotton drill is the best implement for planting; otherwise, hand planting must be resorted to in order that the seed may be placed in moist soil.

The proper depth depends upon the character of the soil and the date of planting. The earlier the seed is put in, the shallower should be the depth. If cold weather follows deep early planting, the seed is likely to rot in the ground, or if germination takes place the seedlings will not have sufficient vitality to force their way through the soil. In Egypt the approved depth is 2 or 3 inches. At Yuma, however, although the soils are lighter than most Egyptian cotton soils and planting has heretofore been done at a later date than is usually the case in Egypt, a depth of only 1½ inches gave excellent results, the seed having germinated readily and the plants having become well established in a very short time.

The cotton plant, when once established, will survive rather adverse climatic conditions, but during the first two weeks after germination it is sensitive to excessive moisture, heat, and cold. The seedlings of Egyptian cotton, however, are hardier than those of Upland cotton and recover more quickly from the effects of cold weather. Dry planting followed by a flooding, which is a frequent procedure in growing grain under irrigation, should never be practiced with cotton. The water packs the soil so firmly about the seed that a poor stand is sure to result. Very little moisture is required to germinate cotton seed provided the soil is lightly firmed about the seed at the time of planting.

When the cotton drill is used in planting, the seed should be dropped about 6 inches apart in the row if the plants are afterwards to be thinned to a distance of 3 feet. If the distance after thinning is to be less than 3 feet, the seeds should be dropped correspondingly closer. When the plants are 6 inches high, or soon after the third leaf appears, they should be "chopped" out to the desired distance with a hoe. If hand planting is practiced, care must be taken in thinning the hills to avoid injury to the plants that are left standing. The difficulty in doing this satisfactorily is one of the principal objections to planting in hills.

In selecting seed for planting only ripe, heavy seed that shows a high percentage of germination[a] should be chosen. Egyptian cotton seed that has been grown in the Southwest for several years is in every way preferable for planting to seed newly imported from Egypt, as it is better adapted to the changed climatic conditions. Plants from such seed have a more determinate growth, yield better, and their bolls open more satisfactorily than those from unacclimated seed.

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[a] A convenient method for testing the viability of cotton or other seeds is to place 100 seeds between two pieces of moist cotton cloth and inclose the cloth and seed between two plates. The number of seeds that germinate constitutes the percentage of viability.

CULTIVATING.

If the ground has been well irrigated and then thoroughly pulverized previous to planting, the plants will reach a height of 8 to 10 inches before a second irrigation is required. Withholding water for some time after planting encourages the development of a deep root system. On the other hand, frequent irrigation at this time encourages the growth of lateral roots close to the surface of the soil, which is undesirable, as plants possessing a root development of this character are the first to suffer in case there is a shortage of water later in the season. Thorough cultivation, so as to establish a dust mulch 2 or 3 inches deep, should follow every irrigation just as soon as the soil is dry enough to be tilled. Conservation of soil moisture by cultivation is cheaper and more satisfactory than frequent irrigation.

On light soils a 14-harrow-tooth cultivator is the best implement to use in forming a dust mulch. On heavy soils a five or seven shoveled cultivator with a pulverizing attachment, followed by the harrow-toothed cultivator, will produce the same results. It is advisable to use the scuffle-hoe attachment for the five-shoveled cultivator in case the field is weedy. If the land is free from weeds, the only hand work necessary will be that required in thinning out the plants and loosening the soil around them after the first irrigation, while they are small and tender. The experience so far obtained at Yuma would indicate that cultivation should cease soon after the plants begin blossoming.

PICKING.

In localities where frost occurs early in the fall, the growing period can be shortened by giving the last irrigation at a correspondingly early date. If this is done, the plants will set their bolls and mature their crop much earlier than when an abundance of water is given throughout the growing season. In localities where the season is comparatively short and it is consequently necessary to restrict the growing period of cotton, closer planting is also to be recommended.

If the cultural methods above described are followed, cotton planted in the Colorado River region in the middle of March should be ready for the first picking by the middle of September. Egyptian cotton has a less determinate growth than the Upland varieties and matures its crop during a longer period and at a lower temperature than the latter. This necessitates a larger number of pickings than for most Upland varieties. The comparatively rank growth of the Egyptian varieties, making work between the rows more difficult, their habit of bearing the bolls at the ends of the branches, thus bending the latter to the ground, and the smaller size of the bolls make picking slower and hence more expensive than with Upland varieties. It is probably safe to estimate that the average cotton picker can gather Egyptian cotton about two-thirds as rapidly as Upland.[a]

In 1907, when the first killing frost did not occur until after the middle of December, four and on some plats even five pickings of Egyptian cotton were made at Yuma. But if the crop is grown on a commercial scale, it is probable that, as in Egypt, only three, or at most four, pickings will ordinarily be made. It is, however, especially important with Egyptian varieties not to leave the cotton unpicked for any considerable length of time after the bolls open, as exposure to the weather damages the fiber. In picking, great care should be taken to keep the cotton as free as possible from fragments of leaves, flowers, bolls, etc. In grading Egyptian cotton much importance is attached to its freedom from "trash," and the price obtained largely depends upon the cleanness of the fiber.

No very satisfactory and economical method has yet been found for removing the stalks that remain in the field after the last picking. The vigorous growth of Egyptian cotton plants makes the methods used with Upland cottons in the South impracticable. Probably as good a way as any is to cut out the plants by hand and throw them into piles; one man can do this work at the rate of an acre a day. Until some economical use is found for the stalks, they can best be disposed of by burning them in the field as soon as they are dry. If there are many immature bolls and green leaves remaining after the last picking, the field can be profitably pastured by dairy stock or beef cattle.

MACHINERY REQUIRED.

No expensive field machinery is necessary in Egyptian cotton culture. When the land has once been leveled, the only implements needed by the individual farmer are an ordinary two-horse walking plow or disk plow, a smoothing harrow, a homemade leveling drag, a two or four horse disk harrow, and a one-horse cotton drill. With the exception of the last, all of these implements are to be found on the average irrigated farm.

In order to prepare the product for the market, more costly machinery, i. e., gins for separating the fiber and presses for baling it, will be required. These can be more advantageously purchased and operated by a cooperative association of cotton growers than by individual farmers. The long fiber of Egyptian cotton can not be separated without injury by the saw gins used for short-staple Upland cottons. Roller gins, such as are used in Egypt and in the Sea Island district in South Carolina and Georgia, will be necessary. A good roller gin, capable of turning out 60 to 100 pounds of fiber an hour, costs at the factory about $150.[a] It will be found more economical to set up a battery of from four to eight gins than to install power to run a single gin. As a rule, in Egypt much greater care is used in ginning than in the United States, and the fiber as it reaches the manufacturer is much cleaner and more attractive looking. If this type of cotton is grown in the southwestern United States, the chances of marketing it advantageously will be much increased by careful ginning.

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[a] Mr. Robert Viewig, who grew Egyptian cotton at Godwinsville, Ga., in 1900, reported to Mr. L. H. Dewey, of the Bureau of Plant Industry, that the negroes in his vicinity preferred to pick Egyptian cotton at the rate of 75 cents a hundred pounds to Upland cotton at 50 cents a hundred pounds.

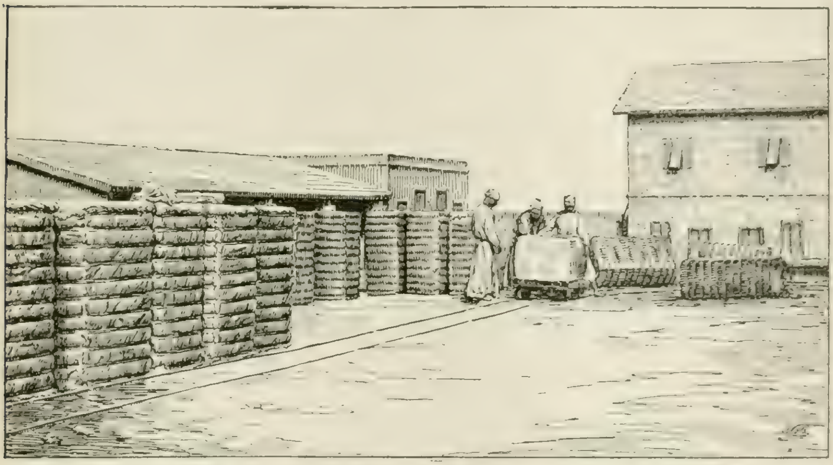

Fig. 2.—Finished Egyptian cotton bales at a ginnery at Kafr ez Zayat, Egypt.

A single-box screw press having an hourly capacity of 1½ bales (hence about the capacity of 10 roller gins) can be purchased at the factory for $160. A revolving double-box press with an hourly capacity of 4 to 5 bales costs from $300 to $500 at the factory. These presses will turn out ordinary rough bales in sufficiently good shape for shipment to one of the southern cities where compresses are operated. At the outset, presses of this description would probably answer the purpose of southwestern cotton growers.

We must not, however, lose sight of the fact that buyers and manufacturers of Egyptian cotton are accustomed to receiving it in the very compact, well-made bales shown in text figure 2. The care with which it is put up has contributed not a little to enhance the reputation of this type of cotton. Almost without exception American users of Egyptian cotton have mentioned the care with which it is ginned and baled as one of their chief reasons for preferring it. If Egyptian cotton culture were to be undertaken on a commercial scale in the Southwest, growers in that section would obtain a great advantage by securing, from the outset, a reputation for care in putting up their product equal to that enjoyed by the Egyptians. To accomplish this a compress will be needed in order to make the bales turned out by the gin presses still more compact. If a compress were located in the region where the cotton is grown, so that the much less bulky compressed bales could be shipped from the point of production, a considerable saving in freight rates would doubtless result. In view of the long haul to a seaport that will be necessary, this is a very important consideration and should not be overlooked by those who may contemplate growing cotton in the Colorado River region.

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[a] Another roller gin that is much used in the Sea Island district is stated to have a capacity of 1½ bales daily. While the saw gin does much more rapid work than the roller gin, it would be almost impossible to market long-staple fiber if ginned on the former machine.

The compresses ordinarily seen in the cotton belt are large establishments located at important shipping centers and costing $35,000 to $50,000. There is, however, a compress manufactured in the United States that costs only $3,800, delivered on the cars at the factory. It is calculated that set up at any point on the railway in southern Arizona or southeastern California it would cost not more than $5,500. This compress is advertised as turning out a bale which is 55 by 21 by 20 to 26 inches in dimensions[a] and which weighs approximately 500 pounds. The daily capacity is said to be from 100 to 125 bales (in a twenty-four-hour day). Such a compress should be able to handle all the cotton produced in a large community. The decreased bulk of the bales, which would result in a saving of freight rates, and their attractive appearance, which would facilitate sales to buyers and manufacturers of this type of cotton, should be ample warrant for installing such a compress in any community where Egyptian cotton growing is seriously undertaken.

ROTATIONS.

The alluvial soils of the Salt, Yuma, and Imperial valleys are for the most part well supplied with all the mineral elements necessary for plant growth, but are often deficient in humus or organic matter, which is essential in maintaining a proper physical condition. Furthermore, cotton, if planted continuously on any soil, will gradually deplete its fertility, being especially exhaustive of nitrogen. In order, therefore, to maintain a sufficient nitrogen content and to increase the supply of humus, leguminous crops should be grown in rotation. For a long-period rotation there is nothing better than alfalfa. But if it is desired to grow cotton at frequent intervals on the same land, winter annual or green manure crops must be introduced. Berseem (Alexandrian clover) is extensively used for this purpose in Egypt, and experience indicates that it will do well as a winter crop under irrigation in the Colorado River region. The productiveness of this clover and the great number of nitrogen-bearing nodules that develop on its roots make it an excellent plant to use in rotation with cotton and with cultivated summer crops in general. Other leguminous plants, some of which will probably prove valuable as soiling or green-manure crops, are being tested in the region. If a proper rotation system is adopted at the outset, commercial fertilizers will probably not be required in this region for many years in connection with cotton raising.

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[a] This bale would therefore be about as bulky in proportion to the weight of its contents as the Egyptian and about two-thirds as bulky as the ordinary American compressed bale.

LABOR CONDITIONS.

The greatest obstacle to cotton culture in the Southwest at present is the difficulty of procuring labor for picking. In this connection it may be stated that picking is the only cultural operation that costs more for Egyptian than for Upland cotton. The cost of preparing the land, planting, irrigating, and cultivating is the same for both kinds. Hence, the total expense to the acre in producing Egyptian cotton is very little more than in producing Upland cotton.

The labor conditions in the Colorado River region are unusual, owing to its remoteness from labor centers. Ordinary farm labor often commands $2 a day or $1.50 with board. Cotton picking, however, can be satisfactorily performed by the cheapest class of labor. Under certain conditions some of the agriculturally inclined Indians might make very good pickers. In the event of cotton culture being developed on a commercial scale, Indian families could probably be employed to do the picking at a reasonable cost. If the industry becomes established in this region, the cost of picking will probably be reduced in proportion as the population becomes denser and the pickers more adept.

It is believed, however, that the best chance of establishing a cotton industry in the Colorado River region is not on the basis of a large individual acreage, requiring much hired labor, but on the basis of 2 to 5 acres to each farm, the farmer's family supplying most of the labor needed. A total acreage large enough to warrant the establishment of a compress could thus be secured. The comparatively small size of the farm units on the Salt River and Yuma reclamation projects will favor this distribution of the cotton acreage among many small growers. On this basis Egyptian cotton may reasonably be expected to become one of the staple crops in the irrigated districts of the hot Southwest.

MARKETS AND TRANSPORTATION.

The Colorado River region is a long way from the manufacturing centers where Egyptian cotton is chiefly used. In the United States these are mostly situated in New England. To market the product to the greatest advantage it will probably be necessary to ship it either to Boston or to Liverpool, the latter city being the greatest market in the world for Egyptian cotton. This will necessitate transportation by railway either to Galveston, Tex., the nearest port on the Gulf of Mexico, or else to some Pacific coast port, whence shipment could be made around Cape Horn. The former route would require a longer haul by railway, but a very much shorter transit by water to ports that are near the manufacturing centers. The latter route will very likely become the cheaper one when the Panama Canal is completed.

There is reason to hope that ultimately there will be a market on the Pacific coast for all cotton grown in Arizona and California. A mill which it is said now obtains from Texas 12,000 bales of cotton annually has been in operation in California for twenty years. Only short-staple cotton is utilized by this factory, but the existence near the Pacific coast of a source of supply of more valuable fiber might encourage the erection of factories adapted for the manufacture of the best grades of cotton goods.

The seed is a by-product of immense value in connection with cotton growing. There would probably be a good local market among dairymen and feeders for most of the cotton seed produced in the Colorado River region, since the price of all feed stuffs is very high there. Oil mills would probably soon spring up on the Pacific coast and would afford a market for any surplus that might exist.

DISEASES AND INSECT ENEMIES.

DISEASES.

The cotton plant is susceptible to a number of diseases caused by fungi and bacteria, the most serious of which in the United States are root-rot, anthracnose or boll-rot, wilt, and the disease which is sometimes known as "black arm." The last is a bacterial disease to which the Egyptian varieties are peculiarly sensitive. The other maladies are due to the attacks of fungi. Boll-rot, or anthracnose, and "black arm" are very apt to be disseminated with seed from infected areas, and it is probable that the wilt disease also can thus be conveyed. In obtaining cotton seed from the Southern States, therefore, great care should be taken to ascertain that the district from which it comes is free from all these diseases.

None of these diseases has as yet appeared as a foe to cotton in the irrigated districts of the Colorado River region, although there is every reason to fear that the root-rot, a disease peculiar to the Southwest, which is more or less prevalent on alfalfa in the Salt River Valley, may also attack the cotton plant. The only preventive measure that can at present be recommended is to avoid planting cotton on land on which alfalfa has died out in a manner suggesting the presence of root-rot. Since this fungus apparently exists in virgin land in the Southwest, sometimes attacking the first crop grown after such land is broken, it will be advisable to give all soil on which cotton is to be planted thorough aeration by means of a deep fall plowing.

THE BOLL WEEVIL.

Of the insects that attack cotton in the United States, the most injurious are the Mexican boll weevil and the bollworm. The weevil is especially to be dreaded in the Southwest. This scourge of cotton culture was first introduced into Texas from Mexico in 1893. It has spread so rapidly that in 1907 the infested area not only included the greater part of Texas and Louisiana, but had extended into Arkansas, Mississippi, and Oklahoma. There is no small danger that the entire cotton belt of the South will ultimately become infested with this insect. The direct loss due to the depredations of the weevil during the season of 1907 is estimated at 385,000 bales, valued at $25,000,000. There is no question that the weevil can be distributed with the seed. For this reason, cotton seed should under no circumstances be introduced into Arizona or California from the weevil-infested regions of the South unless it has been fumigated under proper supervision.

Owing to the danger of introducing not only the weevil but the bacterial and fungous diseases already described, the safest plan will be to import no seed from any section of the South without thoroughly fumigating it upon arrival.

BERMUDA GRASS IN RELATION TO COTTON CULTURE.

Bermuda grass has gained a substantial foothold in the valley of the Colorado River just below Yuma, and conditions there have proved so favorable to its growth that it has become a most serious pest. This is one of the few regions in the United States where this grass produces seed, and it has been found to seed freely there throughout the summer, from May to November.

Since the plant quickly takes possession of ditch banks, where it makes a luxuriant growth, the seeds spread rapidly in the irrigation water and the weed soon gains a foothold on all irrigated land. Having once gained such a foothold, the grass spreads rapidly, and unless vigorous methods are used it soon completely infests the land. On the heavier soils it seems to resist successfully all attempts to eradicate it as long as the land is irrigated. In fact, no cases are yet known at Yuma where heavy land once infested has been entirely reclaimed from it.

Where water is supplied through infested ditches, the utmost vigilance is required to keep the weed in subjection. In view of the fact that cotton requires but little irrigation and permits thorough cultivation, this crop is admirably adapted for use where Bermuda grass infestation is likely to occur, and also where it is proposed to attempt the eradication of the weed.

It seems probable that fair success in eradication might be hoped for if an infested field were pastured down very close during one summer, plowed in the autumn, allowed to lie dry for eighteen months, with an occasional cultivation during the intermediate summer to kill any plants that might start growth, and then planted to cotton the third season. One thorough irrigation in March just before planting and another early in May would be enough to mature the cotton crop, and if these irrigations were followed by thorough and persistent cultivation the growth of Bermuda grass would at least be seriously checked, and such treatment might be sufficient to kill out the plants completely.

It has been noted that a very fair crop of cotton, amounting to nearly one bale to the acre, was produced at Yuma with but two irrigations, one on March 23 and one on May 9, on land that had not been irrigated for nearly a year before the cotton was planted, and which was therefore very thoroughly dried out.

Unless some comparatively drought-resistant crop, such as cotton, can be grown on these Bermuda-grass-infested soils, it will be hopeless to try to reclaim them without keeping them dry and well cultivated for at least two years.

SUMMARY.

During the past ten years the United States has imported on the average 53,000,000 pounds of Egyptian cotton annually. In 1907 the direct imports from Egypt were valued at $16,000,000, and the average price per pound paid in Boston for Egyptian cotton was about 22 cents.

Egyptian cotton resembles Sea Island in many respects, the fiber being long, very strong, and very fine and silky. That of the leading variety, Mit Afifi, is characterized by its brown color. Egyptian cotton is in demand for manufacturing high-grade goods of various kinds and is especially suitable for mercerizing and for mixing with silk.

The Bureau of Plant Industry has for several years experimented with Egyptian cotton at various localities in the southern United States, from South Carolina to central Texas. The results in the main cotton belt do not promise much success, the failure of many of the bolls to ripen before the first killing frost in the autumn making it impossible to obtain the maximum yields.

The Colorado River region in southern Arizona and southeastern California, which is the part of the United States that most nearly resembles Egypt in its long, hot, nearly rainless summers and its agriculture under irrigation, has proved to be well adapted to Egyptian varieties of cotton.

Experiments carried on in the Southwest, especially at Yuma, Ariz., during the last five years, have demonstrated that good yields of high-grade Egyptian cotton can be produced in that region.

Acclimatization has, however, been found necessary, since during the first two or three years of the experiments the plants made an excessive growth of wood and produced relatively few bolls, which ripened late and did not open satisfactorily.

During the past two seasons the size of the plants has diminished, the average number of bolls on each plant has greatly increased, they have ripened much earlier, and they have opened wide, rendering picking much easier.

Careful selection has also been necessary, especially with the principal variety, the Mit Afifi, which, when first introduced into the United States, was found to be much mixed, containing a large percentage of inferior individuals. The average length of the fiber was less than 1⅜ inches, and it lacked the strength, fineness, and uniform light-brown color that characterize the best grades grown in Egypt.

In 1907 the average length of fiber in the experimental field at Yuma was practically 1½ inches, and the strength, fineness, luster, and color were very satisfactory.

The selections include two well-marked types, corresponding to the two leading Egyptian varieties, Mit Afifi and Jannovitch. The first has fiber about 1½ inches in length, crinkly but fine, and of a pronounced brown color. The second, which more nearly approaches Sea Island varieties, averages 1⅝ inches in the length of its fiber, which is silky, lustrous, and of a very light cream color.

Mit Afifi Egyptian cotton yielded at Yuma in 1907 at the rate of 3,300 pounds of seed cotton to the acre. The percentage of lint being about 30, this gives a yield of two American bales, which practically equalled that of any Upland variety grown in the same field.

This yield was obtained with the rows 6 feet apart and the plants 3 feet apart in the rows, while in Egypt the rows average 32 inches apart and the hills 16 inches apart, with two plants in each hill. Hence, in Egypt there are ordinarily ten times as many plants to the acre as in the experiments at Yuma. As acclimatization in the Southwest progresses, the plants will probably become smaller and the distance for planting can be decreased.

Early planting gives much better results than later planting. The seed should be put in as soon as there is reasonable certainty of no further danger from killing frosts.

A level seed bed, with flood irrigation, is probably better adapted to conditions in the southwestern United States than the furrow method of planting and irrigating that is practiced in Egypt.

Cotton is a relatively drought-resistant plant by virtue of its deep taproot, which in the loamy soils of Yuma Valley penetrates from 6 to 8 feet. Consequently, it requires less water than most crops that are grown under irrigation.

Preliminary experiments indicate that even in a rather light loam soil two irrigations after planting suffice to produce a good crop of cotton, provided a thorough cultivation is given after each watering and a good dust mulch is at all times maintained. Irrigation is apparently unnecessary after the first of September. Heavy irrigations late in the season retard ripening and increase the risk of loss from early frosts.

The high fall temperatures of the Colorado River region and the indeterminate growth of Egyptian cotton plants cause the ripening of the fiber to be continued during several months. Three or four pickings are necessary to harvest the bulk of the crop.

The small size of the bolls of Egyptian varieties and the vigorous growth of the plants make picking slower than with large-bolled Upland varieties. To gather 100 pounds of Egyptian seed cotton requires one and one-half times as long as to gather the same quantity from big-bolled Upland varieties.

The greater cost of picking is relatively unimportant, however, in view of the much higher price brought by Egyptian cotton. That of the grade grown at Yuma in 1907 should be worth more than 1½ times as much as Middling Upland cotton. The expense of all other cultural processes is the same for both types of cotton.

At least 600,000 acres of land will be under irrigation in the Colorado River region within a few years. One-fifth of this acreage, with a yield of one American bale to the acre, could produce the average amount of Egyptian cotton that has been imported into the United States during the last ten years.

PLATES.

DESCRIPTION OF PLATES.

Plate I. *Frontispiece.* General view of the experimental field of Egyptian and other varieties of cotton at Yuma, Ariz., in 1907. The breeding rows are shown in the foreground. Plats were also grown for yield tests and for experiments with different times and frequency of irrigation. The rows were 6 feet apart and the plants 3 feet apart in the rows in this field.

Plate II. Fig. 1.—A plant of Egyptian cotton at Yuma in 1903, grown from seed produced by plants grown the year previous from imported seed. The illustration shows the undesirable shape and rank growth of the unacclimatized plants (the shaft of the auger being 3½ feet long); also the comparatively small number of bolls produced. Fig. 2.—Mit Afifi Egyptian cotton at Yuma in 1907, showing the productiveness and satisfactory opening of the bolls brought about by six years of acclimatization and selection. The ripe cotton hangs loose in the fully open bolls, making picking much easier than was the case during the first three years after introduction into the Southwest, when the bolls opened only partially and the cotton had to be pulled out between the points of the valves.

Plate III. Representative plants of Mit Afifi Egyptian cotton at Yuma in 1907, showing the greatly reduced size and improved shape as compared with the plant shown in Plate II, figure 1. The plant with a branch nearly as long as the main stem, shown in the upper figure, is the more typical one. The perfect manner in which the bolls opened in 1907 is well shown in the lower figure.

Plate IV. Open (*b*, *c*) and unopened (*c*, *d*) bolls and detached involucral bract (*a*) of Mit Afifi cotton at Yuma in 1907, natural size. The illustration shows the small, pointed, 3-locked bolls characteristic of the Egyptian type of cotton. The open bolls are seen both from above (*b*) and from the side (*c*).

Plate V. Combed-out seed cotton (natural size) of one of the individual selections of Mit Afifi cotton grown at Yuma, Ariz., showing increased length due to five generations of selection. A is the original selection, grown in 1903 from seed produced the year before from imported seed, and is the progenitor of B, which was produced in 1907. Owing to the curling of the fibers after combing, the full length, which was 1⅜ inches in A and 1⅝ inches in B, is not shown. The illustration represents the average difference in length between the forty individual selections made in 1907 and their progenitors in 1903.

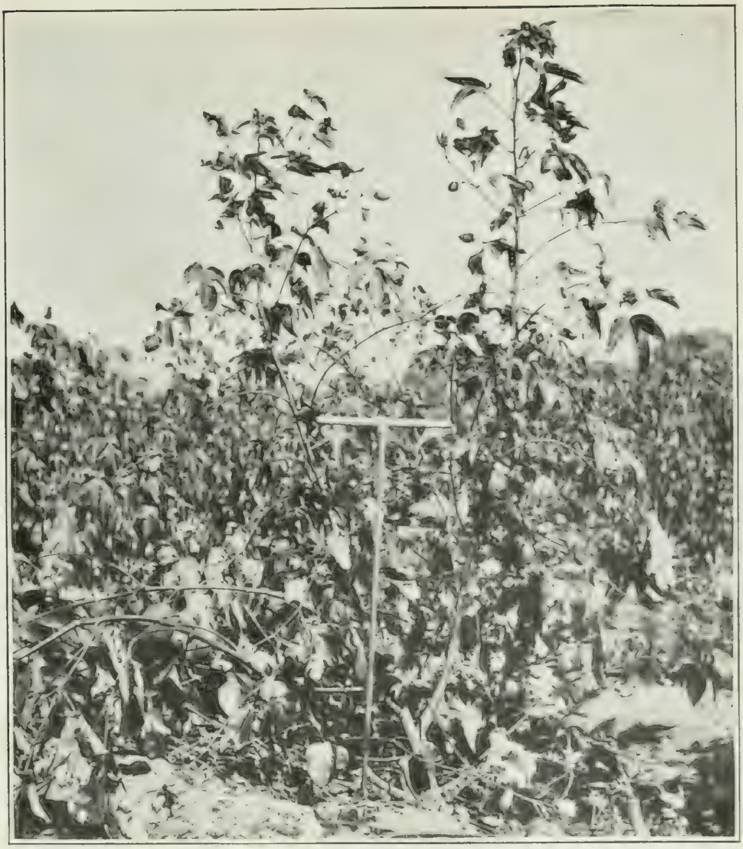


FIG. 1.—EGYPTIAN COTTON PLANTS AT YUMA, ARIZ., IN 1903, SHOWING RANK GROWTH AND RELATIVE STERILITY.

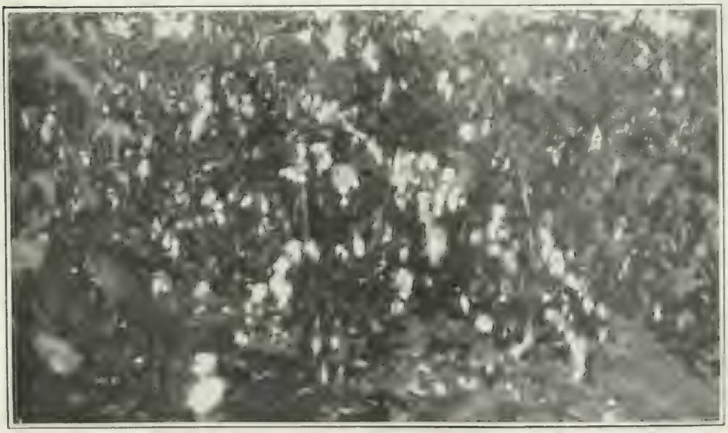


FIG. 2.—EGYPTIAN COTTON PLANTS AT YUMA IN 1907, SHOWING PRODUCTIVENESS AND SATISFACTORY OPENING OF BOLLS.

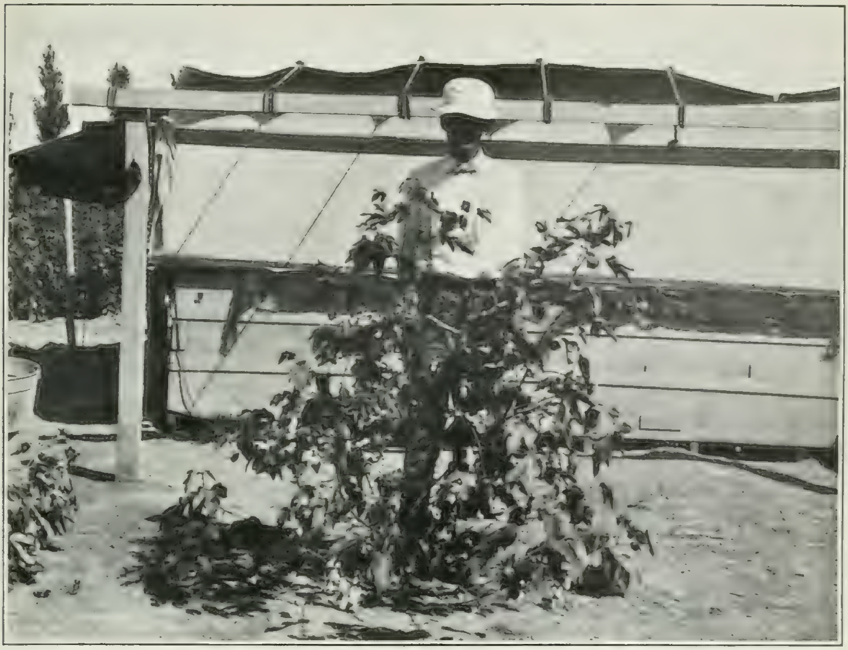


FIG. 1.—TYPICAL MIT AFIFI COTTON PLANT GROWN AT YUMA, ARIZ., IN 1907.

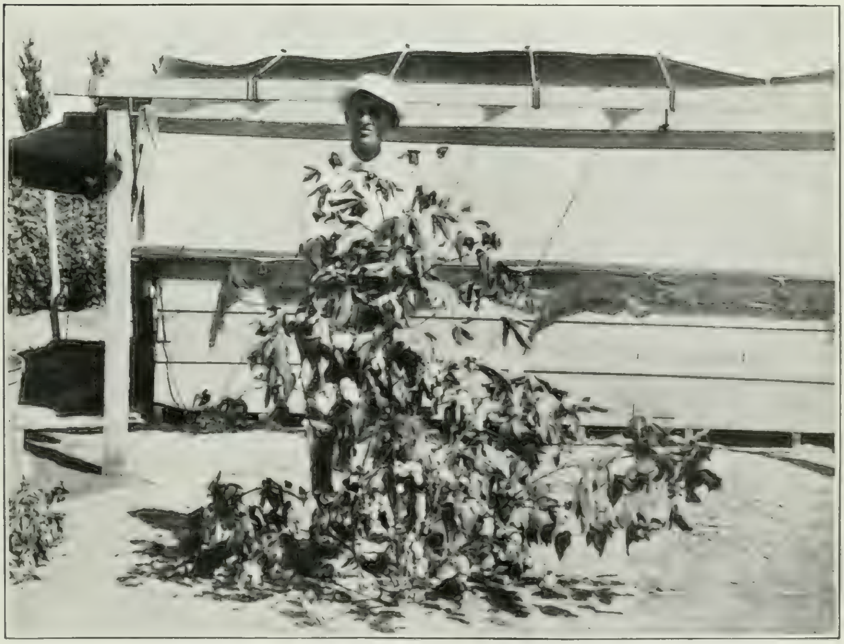
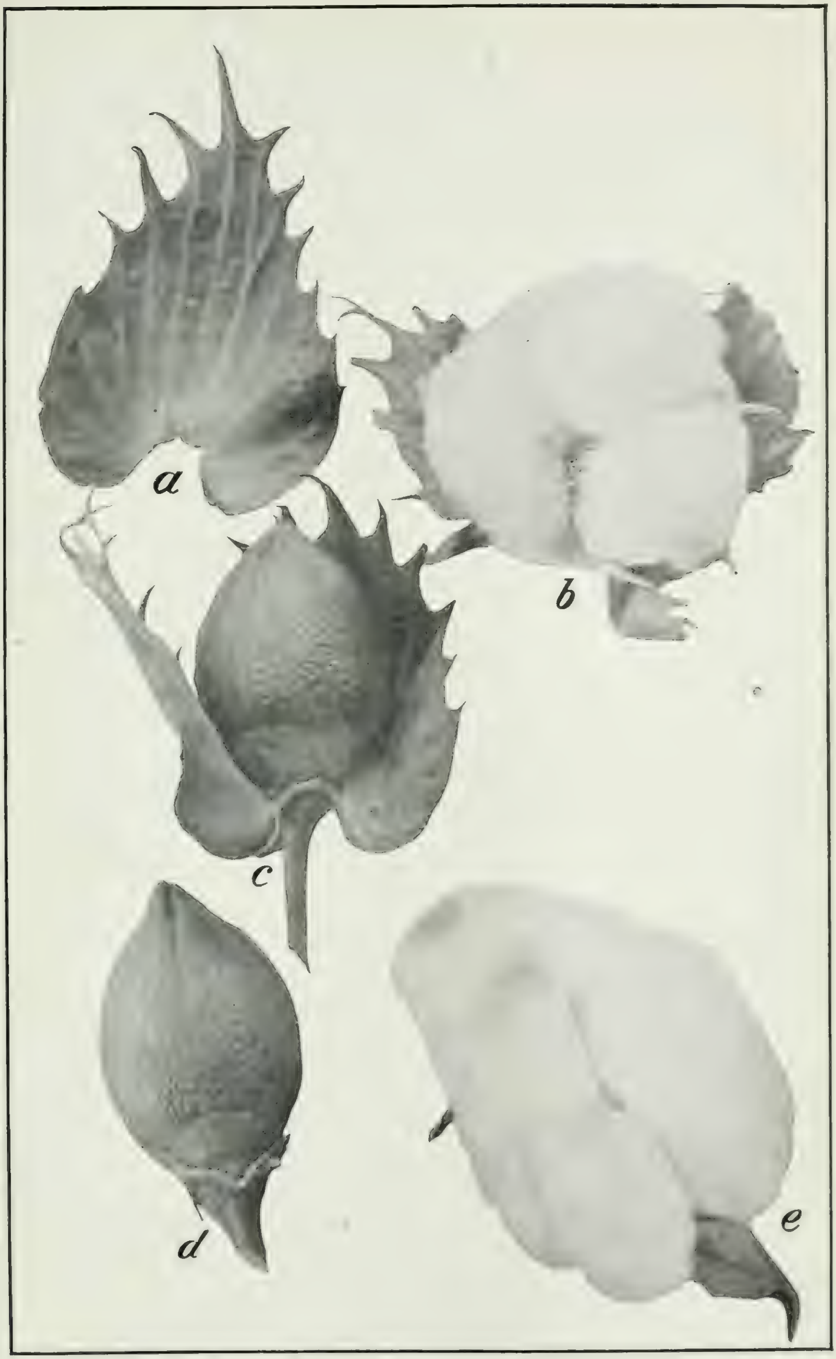
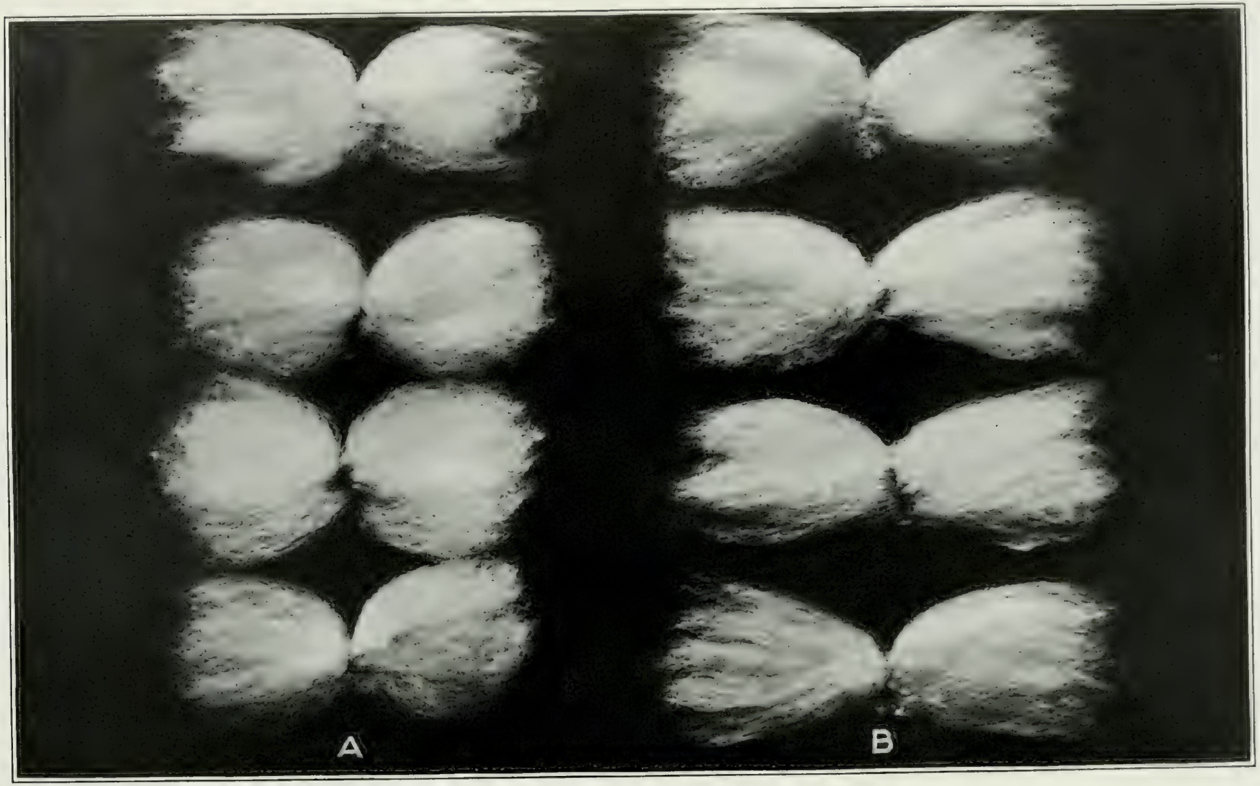


FIG. 2.—ANOTHER TYPICAL MIT AFIFI COTTON PLANT GROWN AT YUMA IN 1907.



OPEN AND UNOPENED BOLLS OF MIT AFIFI COTTON GROWN AT YUMA, ARIZ., IN 1907.

(Natural size.)



MIT AFIFI SEED COTTON, SHOWING IMPROVEMENT BY SELECTION: A, SELECTION OF 1903; B, DESCENDANT IN 1907.

(Natural size.)

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 129.

B. T. GALLOWAY, *Chief of Bureau.*

BARIUM, A CAUSE OF THE LOCO-WEED DISEASE.

BY

ALBERT C. CRAWFORD,

PHARMACOLOGIST, POISONOUS-PLANT INVESTIGATIONS.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., April 10, 1908.

Sir: I have the honor to transmit herewith the manuscript of a technical bulletin entitled "Barium, a Cause of the Loco-Weed Disease," prepared by Dr. A. C. Crawford, Pharmacologist, under the direction of Dr. Rodney H. True, Physiologist in Charge of Poisonous-Plant Investigations, and to recommend that it be published as Bulletin No. 129 of the series of this Bureau.

For many years the stockmen in many parts of the West have reported disastrous consequences following the eating of so-called loco weeds characteristic of the regions involved. While many have doubted any causal relation between the plants in question and the stock losses, the reality of the damage has remained and has seemed to require a thoroughgoing sifting of the evidence concerning the part played by the plants. Accordingly, in the spring of 1905 a station for the experimental study of the problem was established at Hugo, Colo., in charge of Dr. C. Dwight Marsh, Expert, in cooperation with the Colorado Agricultural Experiment Station. Later a further feeding experiment was undertaken at Imperial, Nebr., in cooperation with the Nebraska Agricultural Experiment Station. Parallel with the feeding work in the field, laboratory work, designed to test under laboratory conditions the poisonous action of the plants from given areas, was undertaken at Washington by Dr. A. C. Crawford, Pharmacologist. A further phase of his part of the work was an attempt to ascertain the nature of such poisonous substance or substances as might occur in the loco plants.

In both of these lines of work Doctor Crawford has been successful, and the technical results of his work are here collected.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

INTRODUCTORY STATEMENT.

A scientific understanding of the so-called loco-weed disease has been demanded and sought after for several decades for most practical purposes, but, in spite of the great amount of attention which this problem has received, no general agreement has been found among the results obtained. The field investigations have given such contradictory evidence that until the Bureau of Plant Industry of the Department of Agriculture turned its attention to the matter the whole subject of the loco disease was regarded by many as a kind of delusion and the existence of a distinct entity was freely doubted. Not only did this confusion characterize the field aspect of the matter, but the situation viewed from the standpoint of laboratory study was also much obscured. Some investigators claimed to have separated poisonous substances of various sorts from the loco weeds, while others of equal scientific standing denied the presence of any poisonous substance in the plants under general suspicion—the so-called loco weeds.

In view of the great seriousness of the loco situation from the standpoint of the stock interests, an active campaign both in the line of feeding experiments in the field and laboratory study at Washington was undertaken by the Office of Poisonous-Plant Investigations of the Bureau of Plant Industry.

The feeding experiments carried out at Hugo, Colo., in cooperation with the Colorado Agricultural Experiment Station, before the close of the first season developed evidence that there was in reality such a thing as a loco disease. The investigator in charge was enabled to describe the disease in its most important manifestations and made it possible to sift the facts from the large number of contradictory statements in the literature.

The laboratory work, undertaken and carried on simultaneously, consisted of a pharmacological study, under laboratory conditions and with the usual laboratory subjects, of the action of plant material sent in from the field. The acute phase of loco-weed poisoning, as well as a more prolonged type of the disease, was studied. In plants found in this preliminary feeding to be harmful, the poisonous principle was sought, with the very striking results fully described in this paper. The demonstration of the presence of barium in the plants was followed by barium feeding, with the production of symptoms which agreed with those produced in the laboratory with loco extracts and in the field experiments with the loco plants as seen growing on the range. By comparing these laboratory results with those produced in connection with the field work, it became possible to sift the wheat from the chaff in the mass of contradictory evidence detailed in the literature of this subject.

The practical importance of the discovery of the true nature of the active poisonous principle of the loco weeds is very great. It not only sheds light on the loco situation and enables one to explain many hitherto inexplicable things, but it also adds much to our knowledge of barium in its medical bearings. It opens up most important problems concerning the soils and the relation of the flora to them. It should be borne in mind that although barium is shown to be chiefly responsible for the poisonous properties of loco weeds in eastern Colorado, it is entirely possible that in other regions other substances may be equally or even more significant. This discovery also seems likely to provide a basis for a rational treatment of locoed stock. Unfortunately, the discovery of the fact that barium is the poisonous constituent of loco weeds came too late to aid in the search for remedial measures on the range during the period covered by this report, but those empirically arrived at have received additional support from these laboratory results.

Thus the work in field and laboratory, undertaken after repeated attempts and discouraging failures by others, has yielded results to persistent scientific research and promises practical aid to the now suffering live-stock interests. The results of the laboratory work are presented in this bulletin.

Rodney H. True,
Physiologist in Charge.

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B. P. I.—375.

BARIUM, A CAUSE OF THE LOCO-WEED DISEASE.

GEOGRAPHICAL DISTRIBUTION OF THE LOCO-WEED DISEASE AND ALLIED CONDITIONS.

In our Western States there is a marked annual loss of stock due to various causes. Some of these animals die in a condition known as "locoed," a term derived from the Spanish word "loco," meaning foolish or crazy.

This disorder extends from Montana to Texas and Mexico, and from Kansas and Nebraska to California.[a]

In 1898 the United States Department of Agriculture sent out, under the immediate direction of Mr. V. K. Chesnut, a request for information concerning the ravages of the loco disease. It was found that in the ten States of California, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, Texas, and Wyoming the loss in 1898 was $144,850. Of this amount, $117,300 was attributed to Colorado alone; in fact, the disorder spread so that this State expended more than $200,000 in two years and over $425,000 in a period of nine years in attempts to eradicate the loco plants, the supposed cause of the trouble.[b]

The loss in one area of 35 by 120 miles in southwestern Kansas amounted to 25,000 cattle in 1883.[c] This loss in stock has been so great that the raising of horses has of necessity been abandoned in certain areas on account of the prevalence of these loco weeds.

It is difficult to obtain accurate data, as the ranchmen believe that any information as to the prevalence of the disorder would interfere with the value of their stock.[d]

Dr. James Fletcher, of the Central Experimental Farm, Ottawa, Canada, testified before the Select Standing Committee on Agriculture and Colonization that he had never seen a case in the Northwest of a Canadian bred animal being locoed, although the loco plants were prevalent. He explained this absence of loco disease by the abundance of grass on the range, because of which the animals do not acquire the habit of eating loco plants.[a] Cases have been reported, however, in Manitoba.[b]

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[a] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 271. 1887.

[b] Bur. Animal Industry, 6th and 7th Ann. Repts. (1889 and 1890), p. 272. 1891.

[c] Day, M. G. Loco-Weed. In F. P. Foster's Reference-Book of Practical Therapeutics, vol. 1, p. 587. 1896.

[d] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 18. 1893.

PLANTS ASSOCIATED WITH THE LOCOED CONDITION.

The condition known as "locoed" is popularly believed to be due to eating various plants, especially the members of the Astragalus and Aragallus genera of the Leguminosæ, or pea family, but particularly to *Astragalus mollissimus* and *Aragallus lamberti.* These plants have therefore received the name "loco plants,"[c] or crazy weed. But others, as *Astragalus mortoni*,[d] *A. hornii*, *A. lentiginosus*, *A. pattersoni*,[e] *A. nuttallianus*, *A. missouriensis*, *A. lotiflorus*, *A. bisulcatus*, *A. haydenianus*,[f] *A. tridactylicus*,[g] *Crotalaria sagittalis*, *Lotus americanus*,[h] *Sophora sericea*, *Caprioides aureum*, *Aragallus deflexa*,[i] *A. campestris*,[j] *A. lagopus*,[k] *Malvastrum coccineum*, *Amaranthus graecizans*, and *Rhamnus lanceolata*, are considered by some as loco plants.[l] In other places *Stipa vaseyi*, *Leucocrinum montanum*, *Fritillaria pudica*, *Zygadenus elegans*,[m] and even species of Delphinium are considered loco plants, so widely has this name been used.

In Mexico the term "locoed" embraces a condition due to the action of *Cannabis sativa* and various members of the nightshade family. This term has been much abused and has been made to embrace many groups of symptoms. In fact, if an animal dies while showing more or less stupor it is said to be locoed.[a] The early Spanish settlers seemed to be unfamiliar with the disease, or at least of any causative relation between the plant and the disease. The Spanish name for *Astragalus mollissimus* was "Garbanzillo," from its resemblance to Garbanzo (*Cicer arietinum*), which is used in Spain as a food.[b] The term as applied to this condition seems to be of comparatively recent origin.[c]

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[a] Fletcher, J. Evidence Before the Select Standing Committee on Agriculture and Colonization. Ottawa, 1905, p. 53.

[b] Fletcher, J. Experimental Farms Reports for 1892, p. 148. 1893.

[c] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 555. 1887.—Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Report. (1886), p. 271. 1887.

[d] Eastwood, A. The Loco Weeds. Zoe, vol. 3, p. 53. 1892.

[e] Chesnut, V. K. Preliminary Catalogue of Plants Poisonous to Stock. Bur. Animal Industry, 15th Ann. Rept. (1898), p. 404.

[f] Williams, T. A. Some Plants Injurious to Stock. S. Dak. Agric. Coll. and Exper. Sta. Bul. 33, p. 21. 1893.

[g] Givens, A. J. Loco or Crazy Weed. Med. Century, vol. 1, p. 22. 1893.

[h] Eastwood, A., l. c. 1892.

[i] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 555. 1887.

[j] Amer. Pharm. Assoc. Proc. for 1879, vol. 27, p. 611. 1880.

[k] Kelsey, F. D. Another Loco Plant. Bot. Gaz., vol. 14, p. 20. 1889.

[l] Sayre, L. E. Loco Weed. Kans. State Board Agric., 5th Bienn. Rept., p. 209. 1887.

[m] Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.—Pammel, L. H. Loco Weeds. Vis Medicatrix, vol. 1, p. 44. 1891.

A somewhat similar condition to the loco in stock is sometimes attributed by the ranchmen of our Western States to eating various sages.[d] In Texas the loco disease is known as "grass staggers."[e]

Hayes[f] has described as follows a condition known as grass staggers, which apparently has little resemblance to loco and is supposed to be due to eating overripe grass, especially rye.

> The symptoms, generally, take two or three days to become developed. The animal gradually becomes more or less unconscious and paralyzed and staggers if forced to walk. Although he may have great difficulty in keeping on his legs, he is extremely averse from going down and leans for support against any convenient object. He breathes in a snoring manner. The mucous membranes are tinged with yellow. Convulsions, or spasms, like those of tetanus, may come on.
>
> Recovery may be expected in cases which are not marked by extreme symptoms.

If animals are not regularly salted, they visit salt deposits and eat the alkalis. This some sheepmen believe to be the cause of the locoed condition, but this is disproved by the occurrence of locoed animals in ranges without salt. Others modify this view by claiming that the vitiation in taste from eating these alkalis leads to a desire for the loco weeds and thus to the locoed condition.[g]

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[a] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 275. 1887.—Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.

NOTE.—The symptoms described in Janvier's interesting story, "In Old Mexico" (Scribner's Magazine, vol. 1, p. 67, 1887), would coincide with those due to some member of the nightshade family (probably *Datura stramonium*). See also Pilgrim, C. W., Does the Loco Weed Produce Insanity? in Proc. Amer. Medico-Psycholog. Assoc., vol. 5, p. 167. 1898.

[b] Sayre, L. E. Loco Weed. Kans. State Board Agric., 5th Bienn. Rept., p. 209. 1887.

[c] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 272. 1887.

[d] Mayo, N. S. Loco. The Industrialist, vol. 30, p. 473. 1904.

[e] Science, vol. 9, p. 32. 1887.

[f] Hayes, M. H. Veterinary Notes for Horse Owners, London, 1903, p. 425.—Compare Woronin, M. Ueber die Taumelgetreide in Süd-Ussurien. Bot. Zeit., vol. 49, p. 80. 1891.

[g] Chesnut, V. K., and Wilcox, E. V. Stock-Poisoning Plants of Montana. U. S. Dept. Agric., Div. Bot., Bul. 26, p. 88. 1901.

NOTE.—The wide distribution of these plants is claimed to be partly due to the buffalo. See Blankinship, J. W., The Loco and Some Other Poisonous Plants in Montana, in Mont. Agric. Exper. Sta. Bul. 45, p. 79. 1903.

CLINICAL SYMPTOMS OF LOCOED ANIMALS AS DESCRIBED IN LITERATURE.

The animals usually affected are sheep, horses, cattle, mules,[a] donkeys,[b] and goats. It is claimed that practically all herbivorous animals are liable to the disease, even antelopes being affected.[c] Hogs are said to be unaffected,[d] but definite information is lacking. Cows seem to be less sensitive to this form of intoxication.[e] The condition is usually a chronic one, although acute cases are said to occur at times. The symptoms consist of digestive disturbances, associated with emaciation and various symptoms suggesting lesions in the nervous system, central or peripheral. The animals lose their appetite from the first, begin to emaciate, and show symptoms of malnutrition and starvation. The head trembles, the gait becomes feeble and uncertain, the eyes become sunken and have a "flat, glassy look."[f] There is a general sluggishness, muscular incoordination, and difficulty in motion; finally all control of the limbs is lost and the animal is unable to stand; the coat becomes rough and loses its luster, and, in fact, all the typical symptoms of starvation appear. In some cases diarrhea is also present.

All of Nockolds's animals, however, were constipated and the stools were covered with mucus.[g] The dependent portions of the body may swell, simply as an expression of the anæmia.[h] Sometimes there are symptoms indicating acute pain,[i] the animals running about as if affected with colic. They may belch and their abdomens swell. Some claim that the animals are markedly salivated so that the saliva trickles from their mouths. In other cases the mouth may be dry.[j] The eyes may be rolled up so that the whites alone show. In some cases the pupil has been noted to be dilated, as in atropine poisoning,[a] but Wilcox states that they are contracted as after the use of eserine.[b] The temperature of the animal falls from ½ degree to 1½ degrees F. below normal.[c] Tetanic symptoms may occur,[d] or the muscles of the mouth and tongue becoming paralyzed may interfere with mastication. When water is offered to the animal, it gazes stupidly at it and may not drink for days. One of the symptoms noted is the loss of power to back properly.[e] Cows during the first two or three months of gestation are almost sure to abort.[f] This is claimed by Knowles, however, to be due to malnutrition. As a result of these observations, suggesting some uterine action, the drug has been proposed as an emmenagogue.[g]

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[a] Kingsley, B. F. The Loco Plant. Daniel's Texas Medical Journal, vol. 3, p. 522. 1888.

[b] Schwartzkopff, O. The Effects of "Loco-Weed." Amer. Vet. Rev., vol. 12, p. 162. 1888.

[c] McCullaugh, F. A. Locoed Horses. Journ. Comp. Med. & Vet. Archives, vol. 13, p. 435. 1892.

[d] Eastwood, A. The Loco Weeds. Zoe, vol. 3, p. 57. 1892.

[e] Vasey, G. Plants Poisonous to Cattle in California. Report of Commissioner of Agriculture for 1874, p. 159. 1875.

[f] Vasey, G., l. c., p. 159.

[g] Nockolds, C. Poisoning by Loco Weed. Amer. Vet. Rev., vol. 20, p. 570. 1896–7.

[h] Patterson, A. H. Starvation Œdema. Med. Rev., vol. 56, p. 715, 1899.

[i] Vasey, G. Botanical Notes, Monthly Reports of Dept. Agriculture for 1873, p. 504. 1874.

[j] Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.

The psychical symptoms are shown by errors of judgment. The animal becomes dull and spiritless and wanders about half dazed. The mental dullness passes into stupor. This dull, stupid condition has been compared to intoxication with opium. If the locoed horse is led across a stick lying on the ground he often jumps high as if it were a great obstacle. The animal may now have maniacal attacks, during which he rears and may fall backward,[h] and makes unreasonable jumps and other unexpected movements, thus rendering himself dangerous to man.[i] Other symptoms due to disturbances of the central nervous system are hallucinations of various sorts. Though the optic nerve itself is apparently not affected, the animal will stare at an object for a long time without any apparent comprehension of its nature. This disturbance in the visual function McCullaugh claims to be one of the first symptoms of this disease. The animal seems to lose all idea of distance, as he will butt against an obstruction as if oblivious of its presence. Any sudden or violent motion made before him may cause him to fall. According to some, the animal loses the sense which guides him in finding water. A cow may fail to recognize her calf.[a] There is more or less loss of control of the limbs[b] and tremors;[c] the feet are lifted abnormally high when trotting, and, if crowded, the animal falls headlong and will jump over little hollows as if they were wide ditches.[d] The horse may shy without apparent cause and kick at imaginary objects,[e] and, in fact, the reasoning powers seem to be lost. These attacks are brought on by sudden excitement or when crossing water.[f] There may be cutaneous hyperæsthesia.

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[a] Schwartzkopff, O. The Effects of "Loco-Weed." Amer. Vet. Rev., vol. 12, p. 161. 1888.

[b] Wilcox, T. E. Treatment of "Loco" Poisoning in Idaho Territory. Med. Rec., vol. 31, p. 268. 1887.

[c] Mayo, N. S. Some Observations Upon Loco. Kans. State Agric. Coll. Bul. 35, p. 118. 1893.

[d] McCullaugh, F. A. Locoed Horses. Journ. Comp. Med. and Vet. Archives, vol. 13, p. 436. 1892.

[e] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 12. 1893.

[f] Knowles, M. E. Loco Poisoning. Breeders' Gaz., vol. 39, p. 973. 1901.—Sayre, L. E. Loco Weed.- Kans. State Board of Agric., 5th Bienn. Rept., p. 211. 1887.—Ruedi, C. Loco Weed. Trans. Colo. State Med. Soc., p. 422. 1895.

[g] Miller, C. H. The Loco Weed: Its Probable Usefulness as an Emmenagogue. Southern Clinic, vol. 11, p. 269. 1888.

[h] Vasey, G. Botanical Notes. Monthly Reports of Dept. Agriculture for 1873, p. 504. 1874.

[i] Parker, W. T. The Loco-Weed. Science, vol. 23, p. 101. 1894.

The animals may remain with the herd, but they often wander away. Stalker records the following observations:

> I have seen a single animal miles away from any other individual of the herd, carefully searching as if for some lost object, and when a loco plant is found he would devour every morsel of it with the greatest relish. As soon as one plant was eaten he would immediately go in search of more, apparently oblivious to everything but the intoxication afforded by his one favorite article of food.[g]

All of Nockolds's animals which were locoed were mares more than 6 years of age.[h]

According to Stalker there is a passive type in which the animal shows symptoms only on being disturbed; the animal then becomes unmanageable. This happens even with old, well-broken saddle horses.[i]

There are few published reports as to the symptoms occurring in sheep which are locoed. Stalker[j] says sheep "become loco-eaters, grow stupid, emaciated, and eventually die." One of the few descriptions of the symptoms is that of Ruedi,[k] in which he claims that the symptoms in sheep are those comparable to the symptoms of cerebro-spinal meningitis except that there is an absence of fever. Ruedi speaks of sheep "lying flat on the ground, not able to stand, and not able even to lift their heads to drink the offered water; the head and the vertebra in opisthotonus position; the four legs stretched out and stiff; breathing was stertorous, pulse slow, abdomen much distended, diarrhea present. * * * The heart * * * was very slow and insufficient." The teeth (in sheep) may blacken and fall out.[a]

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[a] Vasey, G. Botanical Notes. Monthly Reports of Dept. Agriculture for 1874, p. 513. 1875.

[b] Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.

[c] Sayre, L. E. Loco Weed. Proc. Amer. Pharm. Assoc., vol. 36, p. 111. 1888.

[d] Nockolds, C. Poisoning by Loco Weed. Amer. Vet. Rev., vol. 20, p. 570. 1896–7.

[e] Knowles, M. E. Loco Poisoning. Breeders' Gaz., vol. 39, p. 972. 1901.

[f] Vasey, G. Botanical Notes. Monthly Reports of Dept. Agriculture for 1873, p. 504. 1874.

[g] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 272. 1887.—Nockolds, C. Poisoning by Loco Weed. Amer. Vet. Rev., vol. 20, p. 570. 1896–7.—Maisch, J. M. Poisonous Species of Astragalus. Amer. Journ. Pharm., vol. 51, p. 239. 1879.

[h] Nockolds, C. Poisoning by Loco Weed. Amer. Vet. Rev., vol. 20, p. 570. 1896–7.

[i] Stalker, M., l. c., p. 273.

[j] Stalker, M., l. c., p. 274.

[k] Ruedi, C. Loco Weed (Astragalus Mollissimus): A Toxico-Chemical Study. Trans. Colo. State Med. Soc., 1895, p. 417.

It is mainly the young animals, such as lambs and colts, that are affected, probably due to the fact that their attention is more easily directed to the flower of the loco[b] plants. It is claimed (on slight evidence) that men have become locoed. The symptoms in them are nausea and headache.[c]

Schuchardt[d] has called attention to the resemblance of the symptoms in locoed animals to those which occur in so-called lathyrism, but most observers in this country have especially marked the resemblance of the symptoms to those induced by the habitual use of narcotic drugs.[e]

As a rule the loco plants are refused by animals save when there is lack of other food, although at times animals have shown the keenest relish for these plants, rejected all other forage, and devoted their whole attention to searching for the loco plants.[f]

Stalker says that animals not too long addicted to the use of these plants, if confined, soon lose their taste for them (after two or three months),[g] although old loco eaters do not readily lose the habit. Stalker also says that "it is to be presumed that the plant is possessed of some toxic property that has a specific effect on the nervous centers, and that these effects have a marked tendency to remain permanent."[a]

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[a] Blankinship, J. W. Loco and Some Other Poisonous Plants in Montana. Mont. Agric. Exper. Sta. Bul. 45, p. 81. 1903.

[b] Blankinship, J. W., l. c.

[c] Day, M. G. Loco-Weed. In F. P. Foster's Reference Book of Practical Therapeutics, vol. 1, p. 588. 1896.—Pilgrim, C. W. Does the Loco-Weed Produce Insanity? Proc. Amer. Medico-Psycholog. Assoc., vol. 5, p. 167. 1898.

[d] Schuchardt, B. Die Loco-Krankheit der Pferde und des Rindviehs. Deutsch. Zeits. f. Thiermed., vol. 18, p. 405. 1892.—Parker, W. T. Loco-Weed. Science, vol. 23, p. 101. 1894.

[e] McCullaugh, F. A. Locoed Horses. Journ. Comp. Med. and Vet. Archives, vol. 13, p. 435. 1892.

[f] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 272. 1887.

[g] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 272. 1887.—See also Linfield, F. B. Sheep Feeding, in Mont. Agric. Coll. Exper. Sta. Bul., 59. 1905.—Special Report on Diseases of Cattle. Bur. Animal Industry, 1904, p. 66.—Wilcox, E. V. Plant Poisoning of Stock in Montana. Bur. Animal Industry, 17th Ann. Rept., p. 115. 1900.

The fundamental character of the disorder seems to be a progressing anæmia. The interpretation of psychical symptoms in herbivora, and especially on the range, must often be fallacious.

CONDITIONS SIMILAR TO LOCO-WEED POISONING IN OTHER PARTS OF THE WORLD.

According to Maiden[b] a condition similar to loco is met with among animals in Australia and is there believed to be due to eating various species of Swainsona.[c] As Maiden says, "Its effect on sheep is well known; they separate from the flock, wander about listlessly, and are known to the shepherds as 'pea-eaters' or 'indigo-eaters.' When once a sheep takes to eating this plant it seldom or never fattens, and may be said to be lost to its owner." Horses, after eating this herb, "were exceptionally difficult to catch, and it was observed how strange they appeared. Their eyes were staring out of their heads and they were prancing against trees and stumps. The second day two out of nine died, and five others had to be left at the camp."

Martin[d] experimentally studied these cases of intoxication and sums up his work as follows:

> 1. That one can by feeding sheep upon Darling pea reproduce all the symptoms which are attributed by pastoralists to this cause. Briefly stated these symptoms are: Stupidity, loss of alertness and an agonized expression, followed by stiffness and slight staggering and frequently trembling of the head or limbs. Later, clumsiness and unsteadiness ensue, which slowly advance until the animal often falls down. In this stage, the action of the animal in running over small obstacles is characteristic. It jumps over a twig as if it were a foot in height. When first it commences to tumble about, it is able more or less readily to regain its feet, but in the advanced stage of the disease this is impossible and, after exhausting itself in efforts to do so, it remains lying down until it dies. During the whole time the sheep become progressively more bloodless, and in advanced cases the blood when shed appears to the naked eye lighter in color. It contains fewer red blood-cells (about two-thirds to one-half the usual number). (The corpuscles were estimated in several cases by means of a hæmocytometer.) All these symptoms are much aggravated by driving. Thus, an animal in which the symptoms are little marked may exhibit them in a striking degree after being driven. In addition to the above the teeth

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[a] Stalker, M., l. c., p. 275.

[b] Maiden, J. H. Plants Reputed to be Poisonous to Stock in Australia. Dept. Agric., New South Wales, Misc. Pub. No. 477, pp. 15, 16. 1901.

[c] Notes on Some American and Australian Plants Injurious to Stock. Agric. Gaz., New South Wales, vol. 4, p. 677. 1894.—Notes on Weeds. The Darling Pea. Agric. Gaz., New South Wales, vol. 3, p. 330. 1893.

[d] Martin, C. J. Report on an Investigation into the Effects of Darling Pea (Swainsona Galegifolia) upon Sheep. Agric. Gaz., New South Wales, vol. 8, p. 366. 1898.

(especially in young sheep) frequently become loose, and consequently displaced or even dislodged.

2. That the time which elapses before the onset of definite symptoms is three to four weeks in sheep of 2 to 3 years old. (It is probable, however, that with younger animals the time is shorter.)

3. That under the conditions of the experiment, the animals survived about three months. They lived, however, an invalid's life. Everything was brought to them, and it is improbable that if feeding exclusively upon the pea, and left to shift for themselves in the paddocks, they would survive more than two months.

4. That if a sheep be returned to proper fodder after one month to six weeks feeding upon the pea, and before the symptoms are fully established, it may recover completely.

5. That when once the paralytic symptoms are established it will not recover; but if returned to proper food, will remain in much the same condition, becoming neither better nor worse.

6. That Darling pea contains a very fair amount of nourishing material so that animals may, provided they eat it readily, retain their condition on it for some weeks, until the poisonous principle contained has had time to exert its effects.

These plants, if fed with other herbage, do not seem to be injurious and apparently lose their harmful action upon being cultivated.[a] As long as salt is properly fed the animals will not eat this plant[b] and are said to suffer no effects from it. Physiological study has shown the presence of a body with marked sudorific power which causes rapid emaciation in frogs.[c]

It has been claimed that these symptoms are due to the presence of a narcotic poison in the plant.[d] Post-mortem examinations were negative save for the presence of a peripheral neuritis.[e]

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[a] Woolls, W. On the Forage-Plants Indigenous in New South Wales. Linn. Soc., New South Wales, Proc., vol. 7, pp. 315–316. 1882.

[b] Guthrie, F. B., and Turner, F. Supposed Poisonous Plant. Agric. Gaz., New South Wales, vol. 4, p. 86. 1894.

[c] Bailey, F. M., and Gordon, P. R. Plants Reputed Poisonous and Injurious to Stock, Brisbane, 1887, p. 25.

[d] Guthrie, F. B., and Turner, F. Supposed Poisonous Plant. Agric. Gaz., New South Wales, vol. 4, p. 87. 1894.

[e] Martin, C. J. Report on the Investigation into the Effects of Darling Pea (Swainsona Galegifolia) upon Sheep. Agric. Gaz., New South Wales, vol. 8, p. 367. 1898. (Further literature on the indigo disease will be found in Bailey, F. M., and Gordon, P. R. Plants Reputed Poisonous and Injurious to Stock, Brisbane, 1887, p. 25).

NOTE.—In Canada a chronic disease associated with cirrhosis of the liver results from eating ragwort, or *Senecio jacobaea*. See Dept. of Agriculture, Canada, Rept. of Veterinary Director General, 1905, Ottawa, 1906, p. 31.—In South Africa a disorder known as nenta appears in goats after eating certain plants, especially *Cotyledon ventricosa*. See Hutcheon, D., Nenta, in Agric. Journ. Cape of Good Hope, vol. 14, p. 862. 1899.

PATHOLOGICAL CONDITIONS IN LOCOED ANIMALS AS DESCRIBED ON THE RANGE.

The pathological features as described by previous writers are a softening and ulceration of the stomach walls[a] and a degeneration of the walls of the intestines with or without perforations. The peritoneum may be found inflamed.[b] The peritoneum and omentum in one case (cow), reported by Sayre, were covered with small nodules. These were probably tubercular in origin. The colon in one horse was found enormously distended, while the cœcum and small intestines were normal,[c] save that the walls appeared thin.

Ulcers have been found at times in the kidneys, but were probably secondary in origin, as other cases are reported with normal kidneys. Faville has found in some cases amyloid degeneration. The pancreas and spleen are reported normal. The abdominal cavity may contain a slight effusion.[d] The liver has been found cirrhotic, and at times shows tubercular lesions of a secondary nature. The inner coat of the bladder has been found softened, and in sheep the bladder may be markedly distended at the autopsy. The cerebral membranes are congested and perhaps adherent,[e] and there may be blood clots over the longitudinal sinus or at the base of the brain. Effusions have been especially noted around the medulla. The arachnoid has also shown slight congestion, and in other cases the membranes showed a slight thickening. The middle ventricle was found filled with yellow serum, while the fourth ventricle contained a hemorrhagic effusion,[f] and the base of the brain was covered by a clot. The hemorrhage may become organized and the brain be held to the membranes by tough organized fibers. In many cases serous effusion is present in the lateral ventricles. The arachnoid space is also in some cases similarly filled. Microscopic examination of the brain in the case of a steer showed atrophy of Purkinjie's cells.[g]

In sheep the post-mortem examination showed paleness, anæmia of the muscles, and great distention of the abdomen. The intestines were found filled with gases, and the mesenteric blood vessels filled with blood. No peritonitis, or ascites, or ecchymoses in the mucous membranes were noted in the autopsies made on sheep by Ruedi. The liver has been seen enlarged. In sheep the brain was anæmic. Microscopically the brain showed atrophy and the Purkinjie's cells disappeared or their processes atrophied. In these sheep the brain was so anæmic that the distinction between the gray and the white matter was hard to define.[a] The membranes of the cord have been found inflamed and adherent, but the spinal cord was usually normal.[b] In some cases, however, the spinal cord has been found softened [c] and œdematous. The arteries of the limbs were gorged with blood,[d] and at the same time there was a collection of serum in the abdominal cavity. Death is thought to be due to starvation.[e] In other words, the pathological condition, according to published accounts, shows little that is characteristic save some action on the gastro-intestinal tract.

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[a] Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.

[b] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 558. 1887.

[c] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 12. 1893.

[d] Faville, in O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 11. 1893.

[e] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 559. 1887.

[f] Stalker, M. The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Rept. (1886), p. 274. 1887.—Sayre, L. E. Loco-Weed. Amer. Pharm. Assoc. Proc., vol. 38, p. 108. 1890.—O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, pp. 16, 17. 1893.

[g] Mayo, N. S., l. c., p. 118.

HISTORICAL SKETCH OF LOCO INVESTIGATIONS FROM A PHARMACOLOGICAL STANDPOINT.

During the western immigration of 1849 the Indians along the Missouri River described to the immigrants a plant (*Astragalus mollissimus*) producing death in horses and cattle, which was preceded by various forms of excitement.[f]

The attention of the United States Department of Agriculture was first called to the toxic action of the loco plants in 1873, when specimens of the plants, which were identified as *Astragalus hornii* and *A. lentiginosus*,[g] were sent from California by Mr. O. B. Ormsby, with the statement that they were poisonous to stock, especially to horses. Mrs. J. S. Whipple also corroborated this information. The botanist of the Department, Dr. George Vasey,[a] published a note and requested further information concerning the plants. These notes were enlarged by a similar contribution by Dr. P. Moffat on *Aragallus lamberti*.[b] The following year Vasey reported with more fullness, and his description of the action of the plants is substantially what we find in most of the books of to-day.

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[a] Ruedi, C. Loco Weed (Astragalus Mollissimus): A Toxico-Chemical Study. Trans. Colo. State Med. Soc., 1895, p. 418.

[b] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 559. 1887.

[c] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 12. 1893.—Klench, J. P. Rattleweed or Loco Disease. Amer. Vet. Rev., vol 12, p. 399. 1888.

[d] Anderson, F. W. Poisonous Plants and the Symptoms They Produce. Bot. Gaz., vol. 14, p. 180. 1889.

[e] McCullaugh, F. A. Locoed Horses. Journ. Comp. Med. and Vet. Archives, vol. 13, p. 436. 1892.

[f] Storke, B. F. The Loco Weed. Med. Current, vol. 8, p. 155. 1892.—Kellogg, A. California and Colorado "Loco" Poisons. Cal. Acad. Sci. Proc. for 1875, vol. 6, p. 3. 1876.

NOTE.—The very early reports of these loco plants were purely botanical. See Torrey, J., Botany, in Report on the United States and Mexican Boundary Survey, by W. H. Emory, vol. 2, p. 56, 1859; also Botanical Register, London, vol. 13, pl. 1054, 1827.

[g] Vasey, G. Plants Poisonous to Cattle in California. Rept. of Commissioner of Agriculture for 1874, p. 159. 1875.

In 1876 Lemmon[c] noted that *Astragalus mortoni* was "a deadly sheep poison." At the same time Rothrock,[d] botanist of the United States Geographical Survey under Lieutenant Wheeler, described these plants, and Kellogg,[e] a botanist in California, reported that *Astragalus menziesii* was causing great losses in horses, sheep, and cattle and claimed that the stockmen had been familiar with this disorder for at least ten or fifteen years. This report of Kellogg was followed by that of Rothrock[f] in 1877.

In 1876 a specimen of *Aragallus lamberti* was sent from Colorado to Professor Prescott, of the University of Michigan, under the name of "crazy weed," with the statement that it was poisonous to horses and cattle and that, while the Mexicans often used it in making beer, it sometimes caused symptoms in men. His pupil, Miss Watson, undertook a study of its chemical properties. She failed to isolate any pure chemical compound, but claimed that in the root there was a body giving alkaloidal reactions and that there was also a resinous body present. Another of his pupils, W. R. Birdsall, took the ground-up root himself in doses of 20 grains at various intervals for several days and later 40-grain doses in one and a half hours, but without experiencing any marked symptoms except colicky pains. A kitten also was given about one and a half ounces of the fluid extract without effect. Prescott[g] sums up by saying that "it would seem that the dried ground root possesses no poisonous properties." The work of Miss Watson was considered of sufficient importance to be abstracted in the Annual Report of the Commissioner of Agriculture for 1878 (1879), page 134.

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[a] Vasey, G. Botanical Notes. Monthly Reports of Dept. Agriculture for 1873, p. 503. 1874.

[b] Vasey, G. Botanical Notes. Monthly Reports of Dept. Agriculture for 1874, p. 513. 1875.

[c] Brewer, W. H., and Watson, S. Geological Survey of California, Botany, vol. 1, p. 155. 1876.

[d] Rothrock, J. T. Notes on Economic Botany, in G. M. Wheeler's Report upon U. S. Geographical Surveys West of the One Hundredth Meridian, vol. 6, p. 43. 1878.

[e] Kellogg, A. California and Colorado Loco Poisons. Cal. Academy of Sciences, Proc., 1875, vol. 6, p. 3. 1876.

[f] Rothrock, J. T. Poisonous Properties of the Leguminosæ. Acad. of Nat. Sci., Phila., Proc., vol. 29, p. 274. 1877.

[g] Prescott, A. B. Laboratory Notes—A Partial Analysis of the Oxytropis Lamberti. Amer. Journ. Pharm., vol. 50, p. 564. 1878.

Gradually the Department of Agriculture became more and more interested in this subject, and Peter Collier, chief chemist, in 1878, examined the roots and leaves of *Aragallus lamberti* for alkaloids, but found none.[a]

In 1880 Peter Collier published a proximate analysis of *Astragalus mollissimus* made by Francis A. Wentz, of Kansas. His investigations showed it to have an ash content of 6.76 per cent, while the *Aragallus lamberti*, analyzed by L. F. Dyrenforth, of Chicago, showed an ash content of 4.32 per cent. Collier[b] sums up by saying:

> From the additional work done at this Department it seems probable that the deleterious effects observed from animals eating this plant may be due principally to the fact that the sweet taste causes cattle to reject more nutritious food and strive to subsist upon the Oxytropis only. This plant is mechanically a very unfit substance for food, being of a tough, fibrous, and indigestible character. It is possible that, when the animal becomes somewhat enfeebled by lack of proper nourishment, the small amount of alkaloid may have a direct poisonous action. Again, it seems probable that the plant may contain much larger proportions of alkaloid at certain stages in its development than at others, or the seeds may prove to be the most injurious portion.

The departmental work was continued by further short notices by Vasey[c] in 1884, 1886, and 1887, and by the report of Stalker in 1887. This report by Stalker is still the best description on the clinical side of the question.

Rothrock,[d] meeting the loco plants in his survey work, describes their effects on animals as follows:

> Certain it is, however, that, once commenced, they continue it, passing through temporary intoxication to a complete nervous and muscular wreck in the later stages, when it has developed into a fully marked disease which terminates in death from starvation or inability to digest a more nourishing food. The animal toward the last becomes stupid or wild, or even vicious, or, again, acting as though attacked with "blind staggers."

Under the name of Crotalaria, H. Gibbons,[e] in 1879, refers to a plant growing in California which it was claimed was producing characteristic symptoms of poisoning in horses and sheep. This plant Professor Maisch afterwards identified as *Aragallus lamberti*.

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[a] Rept. of Commissioner of Agriculture for 1878, p. 134. 1879.

[b] Rept. of Commissioner of Agriculture for 1879, pp. 89, 90. 1880.

[c] Rept. of Commissioner of Agriculture for 1886, p. 75. 1887. Rept. of Commissioner of Agriculture for 1884, p. 123. 1884.

[d] Rothrock, J. T. Notes on Economic Botany, in G. M. Wheeler's Report upon U. S. Geographical Surveys West of the One Hundredth Meridian, vol. 6, p. 43. 1878.

[e] Gibbons, H. Poisonous Effects of Crotallaria—Vulgo Rattle Weed, Loco Weed. Pacific Med. and Surg. Journ., vol. 21, p. 496. 1878–79.

Dr. Isaac Ott [a] undertook the physiological study of the question and used an alcoholic extract of *Astragalus mollissimus*. He found from its action on frogs, rabbits, and cats that the plant had decided physiological action, as follows:

(1) It decreases the irritability of the motor nerves.

(2) Greatly affects the sensory ganglia of the central nervous system, preventing them from readily receiving impressions.

(3) Has a spinal tetanic action.

(4) Kills mainly by arrest of the heart.

(5) Increases the salivary secretion.

(6) Has a stupefying action on the brain.

(7) Reduces the cardiac force and frequency.

(8) Temporarily increases arterial tension, but finally decreases it.

(9) It greatly dilates the pupil.

Doctor Stockman, in England, about this time tried the action of the aqueous and alcoholic extracts of the dried *Astragalus mollissimus* sent from Texas. He experimented with frogs and rabbits in increasing doses, but without result.[b]

In 1888 Hill reported that a species of Astragalus was acting detrimentally on cattle, goats, and sheep in Cyprus and that these animals fell down as if intoxicated, and also that the natives in time of great drought feed their cattle with this plant mixed with straw, but that they were always made sick until they became used to it.

In 1885 Professor Sayre, of the University of Kansas, undertook the investigation of the loco question. His first report was made in the Transactions of the Kansas Academy of Sciences for 1885, and his reports have been continued at various periods up to 1904. The results of his experiments on various animals—dogs, cats, and frogs [c]—have been entirely negative. He administered alcoholic preparations to himself and took them until they became too nauseous to continue, and found they produced absolutely no symptoms besides the nausea. He suggests, however, that if the plant really is poisonous it is due to its fine hairs, which might mechanically cause death. Sayre has stated that he has sent thousands of pounds of the dried loco plants to various investigators in America and Europe, but all reports were negative as to pharmacological activity. He has, however, done some work on the pure chemistry of the plant and found that the plant contained 10 per cent of moisture and yielded 12.01 per cent of ash. Of this ash, 25 per cent was soluble in water, while 50.6 per cent was soluble in HCl. The insoluble portion consisted largely of silica. He found CaO, K_2O, MgO, Al_2O_3, and Fe_2O_3, with the acid radicals SO_3, Cl, P_2O_5, CO_2, and SiO_2.[a] Although Sayre claims that the plant is physiologically inactive, he tried by chemical means to isolate a physiologically active body and, naturally enough under the circumstances, failed to find one. He claims that while the plant might give alkaloid reactions, he was unable to isolate this body in a pure state, and that alfalfa reacted similarly.

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[a] Ott, I. Physiological Action of Astragalus Mollissimus. New Remedies, vol. 11, p. 227. 1882.

[b] Hill, J. R. Note on a Species of Astragalus from Cyprus. Pharm. Journ. and Trans., 3 s., vol. 18, p. 712. 1887–88.

[c] Sayre, L. E. Loco-Weed. Proc. Amer. Pharm. Assoc., vol. 36, p. 112. 1888.

The investigation on animals was continued by Kennedy.[b] He administered an infusion of ½ ounce of green *Astragalus mollissimus* to a fasting dog weighing 23 pounds, but there were no symptoms after 12 hours. A decoction of 1 ounce of the green plant and one of 4 ounces of the dried plant were likewise without action. Extracts with hydrochloric acid were also inactive. When 400 grams of the dried and powdered plant were fed in substance the result was merely to increase the appetite. The organic acid obtained from 4 ounces of the plant was also found to be inert.

Kennedy did not state in what season the plant was collected and from what locality it was obtained, but says simply that the plant extract was inactive to a dog, a carnivorous animal, and that therefore the plant is nonpoisonous. He adds that death might be due to the tough fibers and indigestible character of the plant. He overlooks, however, the fact that the plant might vary in its toxicity, and he infers from the experiments on carnivorous animals that these results would hold good for herbivora, yet he does not claim that carnivora become locoed in nature.

Kennedy found that the plant lost 80 per cent in weight on drying and that the water extract which represented 30.6 per cent of the powdered and dried plant contained magnesium sulphate and sodium chlorid, tannic acid, gum, coloring matter, an extractive, and a "peculiar organic acid." The ashed plant yielded 20 per cent of ash, consisting of magnesium sulphate, sodium chlorid, alumina, silica, and a trace of iron. "The abundant precipitate produced by the alkaline hydrates, potassium, sodium, and ammonium was found to consist of magnesium hydrate, an abundance of this base being present in the plant." Kennedy also obtained alkaloidal reactions, but failed to isolate the body giving these reactions.

In 1889 the investigations were greatly stimulated by the report of Doctor Day,[c] then of the University of Michigan. She claimed that she was able to produce marked physiological symptoms, using both *Astragalus mollissimus* and *Aragallus lamberti* in her work. She administered daily 60 to 70 c. c. of a decoction[a] of the plants to kittens, together with abundant milk and other food. She states that in two days—

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[a] Sayre, L. E. Loco Weed. Amer. Vet. Rev., vol. 11, p. 556. 1887.

[b] Kennedy, J. Loco Weed (Crazy Weed). Pharm. Rec., vol. 8, p. 197. 1888.

[c] Day, M. G. Experimental Demonstrations of the Toxicity of the "Loco Weed." N. Y. Med. Journ., vol. 49, p. 237. 1889.

> The kittens became less active, the coat grew rough, appetite for ordinary food diminished and fondness for the "loco" increased, diarrhea came on, and retching and vomiting occasionally occurred. The expression became peculiar and characteristic. Emaciation and the above symptoms progressively increased until the eighteenth day, when periods of convulsive excitement supervened. At times the convulsions were tetanic in character; frothing at the mouth and throwing the head backward as in opisthotonus were marked. At other times the kitten would stand on its hind legs and strike the air with its forepaws, then fall backward and throw itself from side to side. These periods of excitement were followed by perfect quiet, the only apparent sign of life being the respiratory movements. After a short interval of quiet the convulsive movements would recur. These alternate periods of excitement and quiet lasted thirty-six hours, when the posterior extremities became paralyzed, and the kitten died about two hours afterward. There was no apparent loss of consciousness before death.
>
> The post-mortem examination revealed the presence of ulcers in the stomach and duodenum. Some of the ulcers had nearly perforated the walls of the stomach and duodenum. The heart was in diastole; brain and myel appeared normal. As might be expected from the emaciated condition, the entire body was anæmic.
>
> In a second case 60 to 70 cubic centimeters of a more concentrated decoction were fed daily, with other food as before, to a vigorous adult cat. The symptoms of inactivity, loss of appetite, rough coat, diarrhea, and the peculiar expression of countenance were as in the first case. By the twelfth day the cat was wasted almost to a skeleton, and was correspondingly weak. Paralysis of the hind limbs came on, and the cat died on the thirteenth day. There were no periods of excitement in this case.

These cats developed a craving for the decoction and "would beg for it as an ordinary kitten does for milk, and when supplied would lie down contented."

Doctor Day made controls with healthy animals under the same conditions, with the exception that they received no loco plant. She also fed a young wild jack rabbit on milk and grass for a few days and then substituted fresh loco plants for grass.

> At first the "loco" was refused, but after two or three days the "loco" was eaten with as much relish as the grass had been. After ten days of the milk and "loco" diet the rabbit was found dead, with the head thrown back and the stomach ruptured.
>
> Subcutaneous injections of the concentrated decoction caused nervous twitchings in frogs and kittens, and if large amounts were used death followed in from one to two hours from paralysis of the heart. The same symptoms were produced in frogs by the injection of an alcoholic extract of the residue left after the evaporation to dryness of the decoction.

In other words, Doctor Day was able to produce a chronic form of loco poisoning with the characteristic symptoms so often described save in the occurrence of diarrhea. Diarrhea is not usually noted on the range. Sayre had already reported an ulcerated condition of the intestines of a locoed cow similar to that described by Doctor Day as occurring in cats. Doctor Day urged that the reason previous experimenters failed to produce symptoms was that they had used too small an amount of the plant and that by systematic feeding to healthy cats cases of loco disease may be produced.

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[a] Presumably a 10 per cent decoction, U. S. P.

Storke states that "Dr. V. C. Vaughan, of the University of Michigan, has since fully corroborated Dr. Day's views."[a]

In her experiments Doctor Day used the leaves, roots, and stems of the plants gathered in September. She believed that the greatest amount of poison is present in autumn and winter. She later undertook the isolation of the active principle, and proceeded as follows:[b]

> The roots, stems, and leaves were boiled ten hours, strained, and the decoction concentrated to a sirup, poured, while hot, into a hot flask, corked and set away. At the end of ten days the sirup had separated into two layers—the upper a blackish liquid, the lower a brownish sediment. The liquid was poured into a flask and covered with six times its volume of very dilute alcohol, 30 per cent (the sediment also was washed with dilute alcohol, to insure a complete removal of the liquid), corked, and let stand three days; agitated occasionally, then filtered, and the filtrate slowly evaporated in the air, when crystals were formed. It was found important not to hurry the evaporation, for when this took place too rapidly the crystals did not form.
>
> These crystals are microscopic in size, blue-white in color, and of a variety of forms. The most characteristic are slender and pointed, arranged in rosettes or grouped in various ways. They are soluble in distilled water and very dilute alcohol, very sparingly soluble in strong alcohol, not soluble in chloroform or ether.
>
> The evaporated mass containing the crystals, when dissolved in distilled water, is slightly acid in reaction. A small amount of this fed to a kitten produced the train of characteristic toxic symptoms—sleepiness, loss of appetite, retching, and diarrhea—that is produced by quite large amounts of the decoction.

The crystals Sayre[c] claims to have already seen. He says that they gave no precipitate with Mayer's reagent, platinum chlorid, or with ammonia, but that barium chlorid and ammonium oxalate gave a precipitate, and he believes that they were in reality an inorganic combination of calcium, so that while Doctor Day may have obtained an extract which produced characteristic symptoms she certainly has not isolated any pure active principle. Later she admitted that it was not possible "to make positive statements as to the chemical character of the active principle." [a]

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[a] Storke, B. F. The Loco Weed. Med. Current, vol. 8, p. 157. 1892.

[b] Day, M. G. The Separation of the Poison of the "Loco Weed." N. Y. Med. Journ., vol. 50, p. 604. 1889.

[c] Sayre, L. E. Active Principle of Loco Weed. Notes on New Remedies, vol. 2, No. 12, p. 1.

In 1884 there was a fatal outbreak of a disorder in horses in portions of the Missouri Valley in Iowa, Nebraska, and Dakota. This was almost uniformly fatal in a few weeks or months. The animals lost strength and became emaciated, although they were kept in pasture where there was abundant grass. There was marked stupor, the animals falling asleep while eating, and they "would remain standing for a whole week, sleeping much of the time, with the head resting upon some object." The post-mortem examination showed that "in every instance there was marked hemorrhagic effusion into the fourth ventricle, the liver and spleen were abnormally dense, the walls of the intestines were almost destitute of blood, and the stomach enormously distended with undigested food." The post-mortem find and clinical symptoms suggested to Stalker [b] that this disorder was due to some plant analagous to *Astragalus mollissimus*. He found abundant in these regions *Crotalaria sagittalis*, or rattle-box, one of the so-called loco weeds, and by the administration per os to a young horse of an infusion of 15 pounds of the plant, given in two days, produced the clinical symptoms and the post-mortem condition of the brain which he previously observed on the range.

Power and Cambier [c] undertook the chemical study and the isolation of the active principle of this plant, together with that of *Astragalus mollissimus*. They found that the *Astragalus mollissimus* if distilled with water yielded a distillate which possessed a peculiar odor, which they thought due to a trace of volatile oil. On distilling with alkali they obtained ammonia and a trace of trimethylamine. In the case of Crotalaria only ammonia was found.[d] They argued that because trimethylamine was not obtained in this case choline was not present. On distilling the *Astragalus mollissimus* with acidulated water (H_2SO_4) the distillate was found to contain acetic acid—settling the nature of the "peculiar organic acid" described by Kennedy. From this plant they obtained a resin or mixture of resinous bodies by extracting the plant with alcohol, and after concentration precipitating with acid water. These resins in doses of from 2 to 5 grains failed to produce any symptoms in kittens.

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[a] Day, M. G. Loco Weed, in F. P. Foster's Reference-Book of Practical Therapeutics, vol. 1, p. 588. 1896.

[b] Stalker, M. 1st Ann. Rept. State Vet. Surg. Iowa, p. 16. 1885.

[c] Power, F. B., and Cambier, J. Chemical Examination of Some Loco-Weeds. Pharm. Rundschau, vol. 9, p. 8. 1891.—Power, F. B. Notes on the So-called Loco Weeds. Pharm. Rundschau, vol. 7, p. 134, 1889.—See also Hoffmann, F., Loco-Weeds, in Pharm. Rundschau, vol. 7, p. 168. 1889.

[d] Kennedy, J. Pharm. Rec., vol. 8, p. 197. 1888. Kennedy also obtained ammonia from *Astragalus mollissimus*.

An albuminoid which was obtained by precipitating a concentrated aqueous extract of *Astragalus mollissimus* by means of alcohol likewise was found to be inactive to a kitten in doses corresponding to 50 grams of the crude plant. A globulin which was isolated by precipitation from a 10 per cent sodium chlorid solution proved also to be inactive in doses of 0.2 gram. They then extracted 3 kilograms of these plants with ½ per cent sulphuric acid, and after evaporation to a thick gum the mass was extracted with strong alcohol, the alcoholic solution was evaporated, and the alcoholic residue taken up in water and precipitated by neutral and basic lead acetates, and after removing the lead with sulphureted hydrogen the filtrate gave precipitates with various alkaloidal reagents. The sirupy residue which they obtained from *Astragalus mollissimus* by decomposing the precipitate with Mayer's solution administered to kittens in doses of 0.1 gram produced merely frothing at the mouth with profuse flow of saliva, but the animals soon recovered. The presence of a large amount of calcium was shown but not estimated quantitatively.

Power and Cambier summed up their conclusions by stating that both the Astragalus and the Crotalaria contain very small amounts of toxic alkaloids, to which they believe the symptoms of poisoning produced were due. Their work from a chemical standpoint is excellent, but from a pharmacological point of view seems to be deficient; in fact, Power does not claim to be a pharmacologist. What would seem to be the proper course would have been to test for themselves the action of the plant on various animals and, after deciding which reacted most characteristically, test, after various precipitations, both the precipitates and filtrates on various animals to see whether the original symptoms and pathological lesions could be produced. They failed, however, to test their mother substance. It is well recognized that plants grown under varying conditions and on different soils vary in the amount of the physiologically active principle they contain.

In the case of Crotalaria, Power and Cambier had before them the experiment of Stalker, in which he reproduced the disorder by feeding the plant extract to horses, yet they claimed that the body which they administered was the active principle, merely because it produced some frothing at the mouth and salivation in a kitten. The percentage of active principle they found would be too small to account for the symptoms, except in the case of a very active compound.

Certain of these precipitates were also later examined physiologically by O'Brine.[a] He also found the resin precipitated from an alcoholic extract of the plant and also the alcoholic extract from 2.2 pounds of the dried *Astragalus mollissimus* to be physiologically inactive.

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[a] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 18. 1893.

Oatman,[a] using Power and Cambier's method with alfalfa (*Medicago sativa*), obtained a noncrystalline mass which when given in 0.1 gram dose caused frothing at the mouth in a kitten, but no serious symptoms. This 0.1 gram represented about 5 pounds of powdered leaves and tops of the plants.

Since the appearance of Power and Cambier's work Sayre has published various papers on the loco weeds in the Transactions of the Kansas Academy of Sciences for 1903–4, vol. 19, p. 194, 1905; 1901–2, vol. 18, p. 141; Seventh Biennial Report of the State Board of Agriculture of Kansas, vol. 12, p. 97, 1891; Journal of the Kansas Medical Society, vol. 4, pp. 222 and 241, 1904, etc. He has contributed nothing especially new, but says that "the old theory that an alkaloidal poison is secreted in the plant causing the loco trouble has not been found tenable," but wishes to be understood that he does not discredit the ground for the opinion that in some mysterious way certain disorders occur in cattle in connection with what is commonly called loco weed. He suggests that this connection might be somewhat similar to the relationship between the disorder caused by overfeeding half-starved animals on clover or alfalfa[b] and has had the plant analyzed as to its nutritive value, giving the table in the Transactions of the Kansas Academy of Sciences, vol. 19, p. 194. He makes the suggestion that any injurious action the plants may have might be due to the fine, hair-like projections on the plant which mechanically set up irritation. This supposition can be thrown out at once by the experiment of Day and others, who induced symptoms in animals by extracts of the plant, and by the fact that other coarse plants do not act similarly. This fine, hair-like material was found to constitute about 33 per cent of the plant on grinding. But Sayre himself does not seem to be positive as to any conclusion. He, like O'Brine and others, has obtained alkaloidal reactions from the plant, but states he has obtained similar ones from alfalfa.[c] At one time he said:

> I do not consider loco directly or indirectly the cause of the condition, but am of the opinion that what is called "locoed" is, first, congestion of the brain and spinal marrow (causing blindness and first symptoms), and, second,

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[a] Oatman, H. C. The Poisonous Principle of Loco Weed. Notes on New Remedies, vol. 4, p. 14. 1891–92.

[b] Sayre, L. E. Loco Weed. Kans. Acad. Sci. Trans., vol. 18, p. 141. 1903.

[c] Sayre, L. E. Loco Weeds. 7th Bienn. Rept. Kans. State Board Agric. for 1889–90, vol. 12, pt. 2, p. 99. 1891.

> softening to a greater or less extent.[a] These terms describing the alleged symptoms of "locoism" might occur in well recognized diseases resulting from brain lesions, which latter occur in so-called forage poisoning and poisoning from foul drinking water, etc.
>
> We are not prepared to affirm or deny that the loco weed produces a train of symptoms characteristic of the plant.[b]

Again Sayre states:

> It seems not unreasonable to suppose that the peculiar condition of the animals of the plains, when they gorge themselves with this highly nitrogenous weed, has something to do with the disease. A condition of malnutrition may set in and give rise to the rapid growth of a toxic-producing micro-organism or an irritating principle. This principle may be capable of cultivation and of producing disease artificially. Be this as it may, we feel warranted in saying that the so-called poison is a development within the animal, not a product preexisting in the weed itself.

Sayre also suggests the possibility of the plants producing hydrocyanic acid, which, it is well known, occurs in sorghum.[c] In the Journal of the Kansas Medical Society (vol. 4, p. 243), he claims to have isolated a crystalline body, but this he has not tested physiologically. Sayre especially deserves credit for keeping the loco investigation alive, and no doubt his change in position is due to his lack of facilities for pharmacological testing.

Carl Ruedi[d] fed rabbits daily by a stomach tube with 10 c. c. of an extract (unstated strength) of *Astragalus mollissimus* and recorded the following results:

> After only five injections one of the rabbits died, and the post-mortem showed to a nicety the congestion of the whole tract of the vena portæ and the anæmia of the brain. I put six rabbits under the influence of loco, and the effect was marked, but not rapid, if not given in very concentrated solutions. The solutions were prepared differently, and each of the rabbits had its own preparation, but the effect was nearly the same. In the beginning loco acts as a stimulant; the animals get lively, hilarious, running about, cleaning themselves, etc. This lasts about eight hours, then they become very quiet, sit in a corner of a box, and one can do with them pretty nearly what one likes; they do not move from the place, or just run into another corner, to fall back into the same complacent reverie. One can leave the door open and hammer away at the box, but they do not show any inclination to run away. During the excitement, however, they become fierce, and I had once the opportunity to watch one of the drollest things possible: One of the rabbits, two hours after dosing it, got

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[a] Sayre, L. E. Further Report on Loco Weeds. Notes on New Remedies, vol. 4, p. 80. 1891–92.

[b] Sayre, L. E. The Loco Disease. Journ. Kans. Med. Soc., vol. 4, pp. 241–243. 1904.—What is Insanity in Lower Animals? Journ. Kans. Med. Soc., vol. 4, p. 222. 1904.

[c] Sayre, L. E. Loco Weed. Kans. Acad. Sci. Trans., vol. 18, p. 144. 1903.

[d] Ruedi, C. Loco Weed (Astragalus Mollissimus): A Toxico-Chemical Study. Trans. Colo. State Med. Soc., p. 418. 1895.—Also Treatment of Animals Poisoned by Loco Weed (unpublished article).

loose and ran under a porch. A heavy tomcat came near this hole, and commenced sniffing about; this offended the rabbit highly, and it jumped on the neck of the cat, bit it through the skin, and the cat ran screaming away. When the animals are first under the influence of moderate doses of loco, they suffer greatly from hyperæsthesia of the cutaneous nerves; when one touches them with a stick while lying in a corner, without hurting them, one sees the platysma working away very forcibly, and sometimes they utter sounds of pain. According to my experiments the loco weed works slowly but surely; as soon as the anæmia of the brain sets in, the animals act in every respect mad like; one hour they are excitable, and then again dull and languid as can be. The rabbits eat, when well, very quickly, and whenever they have opportunity; not so the locoed rabbit; he eats slowly for a minute or two, then he goes into a corner and meditates, comes forward to nibble at a carrot or a piece of cabbage, but he never eats greedily, and does not steal it from the mouth of his neighbor, or only very exceptionally. I observed these rabbits for ten days; they did not die, because I gave them weaker solutions; but they all became very ill, and as I had to leave the park I killed them with the needle inserted into the medulla oblongata, and made the post-mortem. In all of these cases I found great congestion in the abdomen, and marked anæmia of the brain. The congestion of the vena portæ commences certainly very early, but still the first symptoms are the nervous symptoms, first as excitants, then depressing or sedative, with a marked hyperæsthesia of the cutaneous nerves.

Ruedi made an attempt to isolate the active principle and separated a base, which he calls "locoin," from an ether shaking. This base, however, he found to be physiologically inactive, but believes the activity to be due to a body which he calls "loco-acid," which is present in the mother liquid after the shaking with ether. He, however, has not obtained this in any degree of purity and gives no chemical data to substantiate this statement save that the fluid was acid.

Experiments made at the University of Pennsylvania with certain loco plants on cats, dogs, and rabbits proved negative.[a]

Other experiments on rabbits have been made by Doctor Lewis. These rabbits were fed on the leaves, stem, and whole plant, and also extracts of one of the loco plants (presumably *Astragalus mollissimus*) for one or two months, without producing any noticeable effect.[b]

This uncertainty in the results of the investigation as to the cause of the loco disease turned the attention of observers into other lines. President Ingersoll,[c] of the State Agricultural College of Colorado, in his autopsies on sheep was struck by the presence of tapeworms (*Taenia expansa*) in the gall duct and small intestines. He apparently tried to prove a relationship between the tapeworms and the locoed condition by feeding the extract of a loco plant to sheep, and thus showing its harmlessness. He prepared a decoction from 20 pounds of loco plant

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[a] The "Loco Disease." Therap. Gaz., vol. 12, p. 30. 1888.

[b] Sayre, L. E. Loco Weed. Kans. Acad. Sci. Trans., vol. 18, p. 142. 1903.

[c] Sayre, L. E. Loco Weeds. 7th Bien. Rept. Kansas State Board Agric. for 1889–1890, pt. 2, p. 98. 1891.

(the species was not stated) and boiled this down from 12 gallons to 1 quart. This concentrated extract was fed in three days to a bottle-fed lamb; this lamb showed no symptoms, although kept under observation for two weeks. This theory of the causation of loco by worms was also considered by Curtice,[a] and later brought forward by Steele[b] and Marshall.[c] This idea is very suggestive when considered in relation to the etiology of bothriocephalous anæmia.[d]

Others, again, have claimed that the disease is due to a parasite found upon the loco plants, but all specimens examined by entomologists proved to be harmless.[e]

Lloyd, from his study of the subject, says:

> From first to last I have failed in obtaining a characteristic proximate principle, either from the fresh or dried plant. The disease called loco was as murky as the milk sickness so prevalent in the new settlements of Indiana and Kentucky in early days, and, like the numberless herbs that have been presumed to produce that obscure peculiar disease, milk sickness, loco was unresponsive to my chemistry.[f]
>
> It may be safely said that if a specimen of the plant were to be examined in the ordinary manner by a chemist who had no idea of its importance he would report that it did not contain a characteristic proximate constituent.[g]
>
> Can it be that an admixture of loco and some undetermined plant or earth infected with bacteria taken with the roots, each innocuous under other conditions, can by digestion together in the stomach and intestines result in the production of a poison?[h]
>
> To sum up, it seems to the writer that the poison of loco is a product, and not an educt.[i]

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[a] Curtice, C. Tape-Worm Disease of Sheep of the Western Plains. Bur. Animal Industry, 4th and 5th Ann. Rept., p. 167. 1889.

[b] Steele, C. D. New Theory about Loco. Farm and Ranch, vol. 20, No. 35, p. 1. 1901.

[c] Marshall, H. T. Loco Weed Disease of Sheep. Johns Hopkins Hospital Bul., vol. 15, p. 181. 1904.—Data as to these parasites of sheep may be found in Curtice, C., The Animal Parasites of Sheep. Bur. Animal Industry, Rept., 1890.

[d] Faust, E. S., and Tallquist, T. W. Ueber d. Ursachen der Bothriocephalusanämie. Arch. f. Exp. Path., vol. 57, p. 367. 1907.

[e] Walshia Amorphella and the Loco Weed. Insect Life, vol. 2, p. 50. 1889–90. Snow, F. H. Loco-Weed. Science, vol. 9, p. 92. 1887.

[f] Lloyd, J. U. Loco, or Crazy Weed. Eclectic Med. Journ., vol. 53, p. 482. 1893.

[g] Lloyd, J. U., l. c., p. 483.

[h] Lloyd, J. U., l. c., p. 484.

NOTE.—Eccles had previously announced a somewhat similar idea. Sayre, L. E. Loco Weed. Proc. Amer. Pharm. Assoc., vol. 36, p. 115. 1889.

[i] Lloyd, J. U., l. c., p. 486.

But Lloyd adds, in speaking of the reports of various experts and ranchmen:

> Their description concerning its toxic action on animals agreed, and it was folly to argue that so many observers from so many sections of the country could be misled. There must be an undetermined something behind the loco weed.[a]

In 1893 O'Brine, from Colorado, and Mayo, from Kansas, reported on their work with the loco plants. O'Brine failed to isolate any alkaloidal or other poisonous body, and his feeding experiments on himself and on rabbits having failed, he sums up in despair: "The more I examine the loco question, the more I am persuaded that we must look for some other cause besides the loco weed."[b] At the end of his report he gives some ash analyses but fails to interpret them. He also fails to give details as to the method of obtaining and estimating his ash. O'Brine's ash analyses are as follows:

Plant.	Total ash.	SiO_2.	Fe_2O_3 and Al_2O_3.	CaO.	MgO.	K_2O.	Na_2O.	H_2SO_4.	Cl.	P_2O_5.	CO_2.
Astragalus mollissimus (whole plant)	12.15	32.77	16.26	6.05	3.11	13.30	3.21	3.9	0.47	6.12	10.55
Aragallus lamberti (whole plant)	13.52	17.08	12.21	14.27	2.62	17.26	5.75	3.22	3.87	3.30	17.87
Astragalus caryocarpus	12.36	7.82	5.97	12.10	3.55	23.35	3.38	5.56	9.0	4.67	20.62

These analyses are evidently incorrect, as O'Brine estimates a carbon content of 4.13 per cent for the first, and for the second 2.22 per cent, showing incomplete combustion.

Mayo[c] experimented with alcoholic and aqueous extracts of dried *Astragalus mollissimus* on guinea pigs, with negative results, and was first led to deny a relationship between the disease and the plants. Later, as a result of the post-mortem findings, he was convinced that his first conclusion was wrong and that "the disease is certainly the result of animals feeding upon the loco weed." Mayo says:

> A careful survey of the experiments performed and observations noted leads me to the opinion that the disease known as "loco" is the result of malnutrition, or a gradual starvation, caused by the animals eating the plants known as "loco weeds," either *Astragalus mollissimus* or *Aragallus lamberti*. If there is a narcotic principle in the plant, chemists have failed to find it and a fluid extract does not possess it, and a ton of the plant eaten by an animal ought to contain enough of the poisonous properties to destroy an animal.

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[a] Lloyd, J. U., l. c., p. 483.

[b] O'Brine, D. Progress Bulletin on the Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 17. 1893.

[c] Mayo, N. S. Some Observations on Loco. Kans. State Agric. Coll. Bul. 35, p. 116. 1893.

Kobert[a] has also tested the activity of *Astragalus mollissimus* and says, "Ich fand *Astragalus mollissimus* ziemlich unwirksam."

Doctor McEackran[b] fed dried *Astragalus mollissimus* and *Aragallus lamberti* mixed with feed to a stabled animal for two months without result. (Animal not stated).[c] Similar negative experiments are reported from the State of Washington, but the amounts used were too small to form any conclusions.[d]

Mr. V. K. Chesnut[e] has busied himself with the loco problem, but mainly in an executive capacity, his own efforts being directed to the study of the relation of the loco plants to the disease on the range. He has done no laboratory work. Chesnut and Wilcox made numerous autopsies on sheep and experiments on animals. They claimed that an extract of *Aragallus spicatus* produced some slight narcotic action in rabbits. Their pathological examinations failed to show any characteristic lesion, but they state that the cerebral membranes were in all cases slightly congested. They deny any causative relationship to the presence of worms or with feeding upon alkalis. They believe that sheep are more likely to become locoed if not salted regularly. Chesnut describes one case in which a lamb became locoed by nursing from a locoed mother.

In 1901 Reid Hunt, at that time a special agent of the United States Department of Agriculture, studied the loco question in Montana, working mainly with *Aragallus spicatus*. He moistened the ground-up plant with 93 per cent ethyl alcohol and then percolated it until exhausted. This extract was evaporated and taken up with water so that 1 c. c. of the solution corresponded to 10 grams of the plant. This was fed to an active young rabbit weighing 490 grams, 6 c. c. being fed by the mouth and followed in about an hour by 10 c. c. more, and two hours after this by 15 c. c. This rabbit showed no symptoms during the following day. The next day it was very dull and there was marked muscular weakness, as the rabbit's legs were spread wide apart and his nose rested on the ground. Later respiration became very slow and the pupils were dilated. The paralytic symptoms increased and finally, after a convulsive movement, the animal died, thirty-six hours after the first feeding. Hunt merely states of the post-mortem examination that the stomach was well filled and that the " walls seem normal."

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[a] Kobert, R. Lehrb. d. Intoxikationen, p. 615. 1893.

[b] O'Brine, D. Progress Bulletin on Loco and Larkspur. Colo. State Agric. Coll. Bul. 25, p. 13. 1893.

[c] After the manuscript of this bulletin was sent to the printer it was learned through Professor Carpenter that this animal was a horse.

[d] Nelson, S. B. Feeding Wild Plants to Sheep. Bur. Animal Industry, Bul. 22, p. 12. 1898.

[e] Chesnut, V. K., and Wilcox, E. V. Stock-Poisoning Plants of Montana. U. S. Dept. Agric., Div. Bot., Bul. 26, p. 95. 1901.—Wilcox, E. V. Plant Poisoning of Stock in Montana. Bur. Animal Industry, 17th Ann. Rept., p. 111. 1900.

NOTE.—The writer wishes to acknowledge the great literary help Mr. Chesnut's card catalogue has been to him in the preparation of this paper.

Hunt tried to isolate an active principle by the Dragendorff method, but failed to obtain any physiologically active shakings. He tried hypodermic injections of 80 per cent alcohol extractions of the fresh green plant, and after the injection of an extract corresponding to 60 grams of the fresh plant there was no effect produced. He tried to induce symptoms by feeding the plant itself to rabbits, but was unsuccessful, as the rabbits refused to eat the plant. He was not able to induce symptoms with the extracts of the dried plant.[a]

Marshall [b] studied the loco question with regard to sheep and practically denies the existence of a locoed condition due to eating the loco plants, but believes the condition due to bad feeding, parasitism, etc. He lays great stress upon the presence of worms, but fails to see that they may be merely a secondary infection superimposed upon an already morbid condition produced by eating the plants. Others have claimed that the cause is an insect living upon the loco plants. Others, again, have suggested an analogy with trypanosome disorders.

Chesnut has held the view that many of the cases of so-called locoed sheep were really due to parasites, but that there was a true locoed condition due to eating the loco weeds.

The lack of agreement in the results of the investigators has caused many to doubt any positive relation between the plant and the disease, and even as late as 1904 Payne [c] practically says these diseases are due to lack of nutrition and not to the loco plant. The matter has been summed up in a recent work as follows:

> Though many chemists have sought for the constituents, none have been able to locate the active properties, the trace of alkaloids, resins, volatile and fixed oils having each in turn been found destitute of it. Yet the poisonous properties are fully established by field observations. The destructiveness of these plants to stock is so great as to have probably caused upward of a million dollars loss in the aggregate, and large bounties have been offered by State governments for an effective method of avoiding such losses. It is considered very probable that the poisonous constituent is albuminoidal.[d]

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[a] Unpublished report.

[b] Marshall, H. T. Loco Weed Disease of Sheep. Johns Hopkins Hospital Bul., vol. 15, p. 182. 1904.

[c] Payne, J. E. Cattle Raising on the Plains. Colo. Agric. Expt. Sta. Bul. 87, p. 16. 1904.

[d] National Standard Dispensatory, p. 868. 1905.

NOTE.—The field experiments of Harding and Tudor are rather conclusive as to the relation of these plants to this disorder. Sayre, L. E., Loco Weed, Amer. Vet. Rev., vol. 11, pp. 553–554, 1887—Blankinship, J. W., Loco and Some Other Poisonous Plants in Montana, Mont. Agric. Exper. Sta. Bul. 45, pp. 83–84, 1903—Loco Disease, Therap. Gaz., vol. 12, p. 30, 1898.

NOTES ON VARIOUS MEMBERS OF THE LOCO-WEED FAMILY.

Astragalus caryocarpus is at times eaten in some of the Western States, but is claimed by some at certain stages of its growth to contain a poisonous principle. Frankforter,[a] from experiments on himself, however, denies this.

Astragalus glycophyllus has been used as a diuretic and *Astragalus exscapus* in the treatment of syphilis.[b] "The seed of *A. boeticus*, planted in Germany and England, are found to be the very best substitute for coffee yet tried, and so used—roasted, parched, and mixed with coffee."[c] *Astragalus nuttallianus*, according to Smith,[d] is a highly nutritious forage plant in spring. *Astragalus crassicarpus* has been prophesied by him to be a valuable addition to early spring soiling crops. *Astragalus adsurgens* (*nitidus*) and one or two other species of Astragalus are still used in Chinese medicine.[e] The Indians of the Southwest are familiar with certain loco plants.[f] The Tewans of Hano are said to eat the root of *Aragallus lamberti*, and *Astragalus mollissimus* is applied locally for headaches by some of the Arizona Indians. One of these species is used as a flavoring material by the Coahuillas and is mixed with other plants as spices.[g] *Astragalus kentrophyta* had a reputation among the Navajos for the treatment of rabies.[h] The use of certain loco plants—*Astragalus mollissimus*—has been advocated on theoretical grounds in the treatment of certain forms of insanity, but without favorable results.[i] In Peru and Chile *Astragalus garbancillo*, *A. unifultus*, and *A. ochroleucus* have been considered injurious to animals.[j] *Astragalus glyciphyllus* and *A. alpinus* have been used in Europe as food for stock.[k]

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[a] Frankforter, G. B. A Chemical Study of Astragalus Caryocarpus. Amer. Journ. Pharm., vol. 72, p. 320. 1900.

[b] Maisch, J. M. Poisonous Species of Astragalus. Amer. Journ. Pharm., vol. 51, p. 240. 1879.—Fleurot. Chimiques et Pharmaceutiques sur la Racines d'Astragale sans Tiges. Journ. de Chim. Med., vol. 10, p. 656. 1834.

[c] Porcher, F. P. Resources of the Southern Fields and Forests, p. 204. 1869.

[d] Smith, J. G. Fodder and Forage Plants. U. S. Dept. Agric., Div. Agrost., Bul. 2 (rev. ed.), p. 12. 1900.

[e] Holmes, E. M. Notes on Chinese Drugs. Pharm. Journ. and Trans., vol. 21, 3 s., p. 1149. 1891.

[f] Hough, W. Environmental Interrelations in Arizona. Amer. Anthropologist, vol. 11, pp. 143, 147. 1898.

[g] Barrows, D. P. Ethno-Botany of the Coahuilla Indians of Southern California, p. 67. 1900.

[h] Matthews, W. Navajo Names for Plants. Amer. Nat., vol. 20, p. 772. 1886.

[i] Givens, A. J. Loco or Crazy Weed. Med. Century, vol. 1, p. 21. 1893.—Compare Hurd, H. M. Amer. Journ. Insanity, vol. 42, p. 178. 1885–86.

[j] Rosenthal, D. A. Synopsis Plantarum Diaphoricarum, Erlangen, 1861, p. 1004. Greshoff, M. Beschrijving d. Giftige en Bedwelmende Planten bij de Vischvangst in Gebruik, p. 51. 1900.

[k] Pott, E. Handb. d. tierisch. Ernährung, vol. 2, p. 113. 1907.

Details as to the use of other Astragali can be found in Planchon, G., Sur les Astragales, in Journal de Pharmacie et de Chimie, 5th series, vol 24, p. 473, 1891; 5th series, vol. 25, pp. 169, 233, 1892.

LABORATORY EXPERIMENTS—PHYSIOLOGICAL.

The first point in our investigations was to determine whether the plant exerted any poisonous action and to find some animal which responded regularly to it: then to ascertain if the lack of results of previous investigators was not due to insufficient doses, and later to see if by feeding smaller amounts at repeated intervals symptoms comparable to those described as occurring on the range could not be produced. The animal finally selected was the rabbit.

EXPERIMENTS ON RABBITS.

ACUTE CASES.

Experiment No. 1.—On September 8, 1905, an aqueous extract of 333 grams of fresh *Astragalus mollissimus*, made in Hugo, Colo., and shipped preserved in chloroform,[a] killed a rabbit weighing 1,616 grams in one hour and thirty-five minutes, while an extract corresponding to 167 grams merely caused drowsiness and loss of appetite in a rabbit weighing 765 grams.

Experiment No. 2.—On November 29, 1905, a rabbit weighing 1,162.3 grams was fed with a concentrated aqueous extract of 500 grams of fresh *Astragalus mollissimus*, which had been shipped from Hugo, Colo., preserved in chloroform in sealed vessels. This animal died in one hour and ten minutes. The symptoms consisted in dullness, rapid respiration, and signs of pain. At autopsy the stomach and upper part of the small intestines showed hemorrhagic ecchymoses, with dilation of the dural vessels of the brain and cord, with a clot over a portion of the spinal cord.

Experiment No. 3.—On February 13, 1906, a rabbit weighing 992 grams was fed with a concentrated aqueous extract of 500 grams of the fresh *Astragalus mollissimus*, collected in September and preserved in chloroform water. Before feeding, the rabbit's ears were warm and the rabbit struggled when any attempt was made to turn him on his back. The temperature at 10.50 a. m., the time of feeding, was 103.5° F.; at 11.15 a. m., 102.5° F. At 11.30 a. m. the rabbit was breathing very rapidly and would stay on his back for some time if placed so. The temperature at this time was 102.6° F. Both pupils, the one exposed to the light and the one protected, were contracted. At 12.02 p. m. convulsive movements of the legs appeared. The rabbit made one leap, the temperature rose to 103.6° F., and after a few convulsive movements of the limbs the anus relaxed and a small stool appeared, the pupils dilated, and the animal died at 12.06 p. m.

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[a] In all cases in which the plants were preserved with chloroform sealed vessels were used for shipping. The chloroform was carefully evaporated off in vacuo before feeding the extract, the evaporation requiring several hours. The plants were collected by Dr. C. Dwight Marsh, in charge of the field investigations at Hugo, Colo.

Experiment No. 4.—The feeding of the extract of 464 grams induced a fall in temperature of 2.4° F. in three hours, and the rabbit died several hours later (at night).

Experiment No. 5.—March 2, 1906, a rabbit weighing 928 grams was fed with a concentrated extract of 500 grams of the fresh seeds and pods of *Astragalus mollissimus*, made in September, 1905, and preserved with chloroform water. This animal died in one hour and seven minutes. The animal showed the usual post-mortem conditions.

It was thus found that the aqueous extract of 500 grams of the fresh *Astragalus mollissimus* would cause death in about one hour in rabbits weighing about 2 pounds (907 grams), these rabbits showing constant clinical symptoms—urination, paralysis, more or less convulsive muscular twitchings, often terminating in general convulsions, drowsiness, and stupor, with more or less anesthesia. The pupils at the time of death were often unequal. At first there was usually a slight rise in temperature, but this was soon succeeded by a fall. Often there were soft stools. The post-mortem lesions in these cases were marked congestion, with hemorrhages in the stomach walls and a secretion of thick mucus. The portions of the stomach walls most affected were the dependent portions near the cardiac end. The intestines showed dilatation of the blood vessels. The mesenteric vessels and also the vessels in the cerebral portions of the dura were markedly dilated; in some cases there were clots, especially at the posterior portion of the brain, between the cerebrum and the cerebellum. At times there were clots over the dorsal portion of the cord. On cutting into the brain the brain substance itself did not appear to be congested. The cord seemed about normal, but the vessels of its membranes were well marked. The other organs showed nothing characteristic macroscopically. These experiments were repeated many times and found to be constant.

These acute symptoms were likewise produced by an extract of 500 grams of the fresh *Aragallus lamberti* from Arizona preserved in chloroform water (rabbit weighing 1,998 grams). An aqueous extract of 150 grams of the dried *Astragalus mollissimus*[a] from Imperial, Nebr. (1906), caused death in one hour and fifty-eight minutes in a rabbit weighing 1,530 grams, and an extract of 100 grams killed in one hour and twenty-two minutes a rabbit weighing 736 grams.

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[a] All extracts from dried material were made at Washington.

An aqueous extract of 100 grams of the dried *Astragalus bigelowii* induced death in one hour and thirty-eight minutes, the rabbit weighing 1,502 grams.

An aqueous extract of 150 grams of *Astragalus nitidus* collected at Woodland Park, Colo., in 1906 induced death in three hours and five minutes, the rabbit weighing 1,672 grams.

An aqueous extract of 200 grams of the dried *Astragalus bisulcatus* caused death after several hours (at night), the rabbit weighing 2,423 grams.

In certain cases this production of acute symptoms was not entirely a question of salt action, as was shown by certain other experiments. In other cases salt action seems to be the important factor, so that the production of these acute symptoms can not always be considered characteristic.

CHRONIC CASES.

Experiment No. 6.—February 19, 1906, a large gray rabbit weighing 2,055.3 grams was fed with 60 c. c. of fluid representing the concentrated aqueous extract of 250 grams of the fresh *Astragalus mollissimus*, collected September 18, 1905, and preserved in chloroform. This rabbit was very hard to hold. The ears rested on the body. The temperature at the time of feeding, 1.30 p. m., was 102.3° F. At 2.57 p. m. the animal looked dull but resisted handling. At 3.30 p. m. it urinated. At 4.15 p. m. the temperature was 98.5° F., the pupils were about the same size as before feeding, and the animal became much duller. The next day at 12.50 p. m. the temperature was 102.4° F., and at this time the animal could be handled with greater ease. The animal ate in the morning. The same amount of extract was again fed at 1.24 p. m. At 1.35 p. m. the animal was much duller and could be turned on his back with ease. If disturbed he ran against the wall as if utterly unconscious of the obstruction. The animal had soft, liquid, brown stools and tried to lie down as much as possible. If turned on its back with the feet up it would stay so almost indefinitely. Temperature, 103,8° F.; respiration very rapid. At 2.40 p. m. the temperature was 99.8° F., and the animal died a few minutes later. After death the pupils were much contracted. The vessels of the dura covering the brain were much dilated, but the vessels inside the brain were not dilated. The stomach walls were congested and marked with numerous petechiæ and covered with mucus.

Experiment No. 7.—On February 19, 1906, a white and brown rabbit whose temperature was 103.2° F. was fed 30 c. c. of aqueous fluid representing the concentrated extract of 125 grams of the fresh

Astragalus mollissimus, collected September, 1905, and preserved with chloroform. The rabbit weighed 1,502.5 grams. This extract was fed at 1.45 p. m., and at 4.15 p. m. the temperature was 102.6° F., but there were no marked symptoms. The following day at 2.04 p. m. the temperature registered 102.5° F. The same amount of extract was given at 2.09 p. m. The temperature at 4 p. m. was 99.8° F., the animal was dull, and the pupils were perhaps a little smaller. The animal could not be turned over without resistance. The following day, February 21, at 1.30 p. m. the temperature was 102.6° F., and at 1.45 the same amount of extract was given. At 1.54 p. m. the animal was much duller and the breathing was very rapid. At 4.10 p. m. the temperature was 101.3° F. The animal had been dull ever since the feeding was begun. It nibbled food shortly before the last feeding. On February 23 the same amount of extract was given at 2.16 p. m., temperature 99° F. The breathing was very rapid, the ears shaking, and there was a sleepy, dull look about the animal. At 3.30 p. m. the animal was dull, but would still walk about if disturbed. At this time the animal weighed 1,445.8 grams. At 4.30 p. m. the temperature was 102° F. and the pupils were about normal size. There was a marked sleepy look about the animal, which sat quietly in its cage.

February 24, at 1 p. m., the animal was very dull and could with ease be turned on its back with its feet in the air. It would sit in its cage perfectly quiet. The weight at this time was 1,417.5 grams, the temperature 96.6° F. On February 26 the animal weighed 1,360.8 grams. It was dull and refused to eat. The abdomen felt very distended and tympanitic. February 27 the weight was still 1,360.8 grams, and the animal sat in its cage as if asleep, with eyes half closed. There was no diarrhea and the abdomen was very distended. At 11.15 a. m. there was a general convulsion and the animal fell over. At 12 m. the abdomen seemed even more swollen, the animal was hardly able to walk, and it fell over, uttering a cry. Pupils were about normal—perhaps a little smaller. The animal died at 12.10 p. m.

The post-mortem, made immediately after death, showed the abdomen markedly tympanitic, and the large intestines could be outlined through the abdominal walls with ease. The large intestines were of a chocolate color, intensely congested, and marked with hemorrhages. On opening the abdomen there was a decided putrefactive odor, and about an ounce of bloody fluid was found in the peritoneal cavity, together with fibrin flakes. The stomach was pale, the first three inches of the small intestine up to where it turned sharply were pale, and below this the intestines were injected and full of gas and of a dark red color. The kidneys were 3½ centimeters long and were pale.

capsules easily peeled off; cortex pale. Liver pale and infected with some coccideæ. The gall bladder was one-quarter inch wide and one inch long. Spleen a trifle pale; lungs pale, nothing abnormal; heart relaxed. On opening the stomach gas and fluid, with some food, exuded. The walls were pale, but pink in some places. There was no marked congestion or hemorrhage or perforation. The mesenteric vessels were dilated. The upper portion of the intestines contained a little mucus-like fluid, but lower down became bloody, and still lower contained pus-like fluid. The walls were hemorrhagic. The large intestine contained a soft, fecal-like fluid, very foul. Its walls were much congested and full of hemorrhagic points. The cortex of the suprarenal bodies was sharply defined, the medullæ brownish. Brain pale, some dural vessels well marked, no clots or hemorrhages. Base of brain pale. No congestion seen on cutting into the brain. Spinal cord showed no hemorrhages or lymph effusions.

Experiment No. 8.—On February 18, 1906, at 2 p. m., a rabbit whose temperature was 102.2° F. was fed with the aqueous extract of 125 grams of fresh *Astragalus mollissimus*, collected in September, 1905, and preserved in chloroform, 30 c. c. of the fluid being used. At 4.25 p. m. the temperature was 102.4° F. No symptoms were noted. This rabbit weighed 1,644.3 grams. On February 20 at 2.09 p. m. the temperature was 102.2° F. and the rabbit showed no symptoms. The same dose was repeated at 2.15 p. m. At 4 p. m. the temperature was 100.3° F. The rabbit was dull but could not be turned over without a struggle. February 21 at 1.30 p. m. the temperature was 101.4° F. The same amount of extract was fed at 1.45 p. m. At this time the animal was dull and breathed more rapidly. At 4.10 p. m. the temperature was 97.3° F. Next day the same amount of extract was again given at 2 p. m. At 2.16 p. m. the breathing became rapid and the animal duller. The ears were directed forward. At 4.15 p. m. the temperature was 101.6° F.; weight 1,757.7 grams; animal slightly dull. February 24, temperature 102° F., weight 1,786 grams. March 5, weight 1,729.3 grams. The animal was fed at 3.20 p. m. with a concentrated extract of 125 grams of *Astragalus mollissimus*, collected in September. Temperature at time of feeding 100.4° F.; 3.40 p. m., no symptoms; 4 p. m., temperature 102° F. March 7, weight 1,644.3 grams; March 8, weight 1,672.6 grams; March 10, weight 1,701 grams; March 12, weight 1,658.4 grams; March 14, weight 1,701 grams.

In this case, where the same dose was given in a period of five days, very little effect on the rabbit was noted.

Experiment No. 9.—On March 1, 1906, a black rabbit weighing 2,664.8 grams was fed with a concentrated aqueous extract of 250 grams of fresh *Astragalus mollissimus*, collected in the fall of 1905.

On March 5 the weight was 2,296.3 grams. The animal was then given the same amount of extract. During the afternoon it passed mucus and thick pieces of feces and was dull; respiration very rapid. March 6, weight 2,282 grams; March 7, 3 p. m., animal very dull and would not eat; sat hunched up, but resisted being disturbed; weight 2,310.5 grams. March 8, weight 2,183 grams; March 9, weight 2,069.5 grams. Pupils dilated; finger could be run almost against the eye, provided the lashes were not touched, without the animal winking or paying any attention. Rabbit ate very little and had not urinated since the preceding day. Left ear had fallen to the side as if the animal were unable to support it. Weight, 1,912.8 grams. From March 9 to March 11, 67 c. c. of cloudy urine were voided. This did not clear with acetic acid. Left eye tearing. March 10, head held to right side. March 12, weight 1,786 grams. Left pupil smaller than right, neither responding to light. Rabbit very weak. March 14, weight 1,729.3 grams. Would not eat. March 16, weight 1,644.3 grams. Right pupil larger than left, neither responding to light. Diarrhea present. Breathing noisy. In sitting down she raised herself on her forelegs, evidently to take the pressure off her abdomen, which was distended. If disturbed, she would butt against the side of the cage, apparently oblivious of its presence. Knee jerks were very active, almost a clonus. Reflex from tendo Achillis active. March 17, forelegs spread out, head falling to left side. The temperature had fallen below 94° F. and would not register on the ordinary clinical thermometer. The ears twitched, the head was thrown back, the abdomen was distended, and the rabbit gritted its teeth. Died. Weight, 1,559.2 grams.

Brain and spinal cord pale. Dural vessels plainly seen but not marked. Intestinal vessels congested. Stomach pale; nothing apparent macroscopically save a small pin-point ulcer.[a] Heart relaxed. Post-mortem examination otherwise negative macroscopically.

Experiment No. 10.—A mouse-colored rabbit weighing 1,927.8 grams was fed February 18, 1906, at 2.26 p. m., with a concentrated aqueous extract of 250 grams of fresh *Astragalus mollissimus* collected in September, 1905, and preserved in chloroform water. The temperature of this rabbit was 102.6° F. The fluid given was 40 c. c. At 2.45 p. m. the rabbit urinated and at 2.57 p. m. was dull and the respiration became rapid. The animal then aborted and had three young, two of which showed some movement after birth, but were apparently premature.

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[a] Compare Plönius, W., Beziehungen d. Geschwürs u. d. Erosionen d. Magens z. d. funktionell. Störungen u. Krankh. d. Darmes, Arch. f. Verdauungsk., vol. 13, pp. 180, 270, 1907, and Tixier, L., Anémies Exper. Consée. aux Ulcér. du Pylore, Comp. Rend. Hebd. Soc. de Biol., vol. 62, p. 1041, 1907.

On February 23 the temperature of this rabbit was 102.9° F. at 1.40 p. m. She was then fed with the same amount of the extract as before. At 2.16 p. m. she lay down and became much duller; left ear fallen to side. At 3.30 p. m. the rabbit was unable to stand. The pupil of the eye exposed to the light was dilated. The animal died without a struggle. The stomach contained much bloody mucus. In the dependent portion of the stomach near the cardiac end were marked petechiæ in the walls, with bright-red blood in the stomach itself. The heart was relaxed. The intestines showed nothing abnormal. The dural vessels of the brain were dilated; there was a clot on the dura over the fourth ventricle. Spinal cord and kidneys normal, the capsules not adhering. Weight, 1,786 grams at death.

Experiment No. 11.—On March 1, 1906, a rabbit weighing 2,126.2 grams was fed with a concentrated aqueous extract of 250 grams of the fresh *Aragallus lamberti* preserved in chloroform water. On March 5 this dose was repeated, 37.5 c. c. of the fluid being used. March 6 the rabbit weighed 1,956 grams; March 7, 1,913.6 grams; March 8, 1,828.5 grams; March 9, 1,701 grams; March 12, 1,672.6 grams; March 14, 1,644.3 grams.

Experiment No. 12.—January 19, 1906, a concentrated aqueous extract of 500 grams of the fresh *Aragallus lamberti* preserved with chloroform water was fed to a rabbit weighing 785 grams. The temperature at 12.10 p. m., the time of feeding, was 101.6° F. The temperature 1 hour and 43 minutes later was 94.6° F., and the animal died shortly after, showing the same condition as occurred after feeding extracts of *Astragalus mollissimus.*

PREGNANT ANIMALS.

Experiment No. 13.—A large, gray, pregnant rabbit weighing 2,891.6 grams was fed on February 22, 1906, with 42 c. c. of fluid, corresponding to the aqueous extract of 250 grams of *Astragalus mollissimus* collected in September and October, 1905, and preserved with chloroform. At 4 p. m. the animal was dull, but still resisted efforts to handle. On February 24 this animal weighed 2,778.2 grams, and on February 26 it bore a litter of seven young rabbits. One or two of these showed movements of the limbs, but were apparently immature. This rabbit on March 10 weighed 2,537.3 grams; March 12, 2,438 grams; March 14, 2,508.9 grams; March 22, 2,494.7 grams.

Experiment No. 14.—On March 1, 1906, a black rabbit weighing 2,721.6 grams was fed at 12.15 p. m. with a concentrated aqueous extract of 250 grams of the fresh *Astragalus mollissimus* collected in September, 1905. On March 2 it weighed 2,438 grams; at 2.58 p. m. it still resisted efforts to turn it on its back; at 3.15 p. m. it could be turned on its back with ease. March 6 the weight was 2,338.8 grams;

March 7 the animal was very dull, would not eat, pupils dilated, hind legs paralyzed; died during the night; weight, 2,267.9 grams.

The stomach walls were pale save at the dependent portion near the cardiac end, where there was a hemorrhagic, ulcerated area about 1½ by 1½ inches. The intestines were full of gas, but not hemorrhagic. The uterus contained eight immature fœti. The uterine walls were hemorrhagic. The kidneys weighed 9½ grams; their medullæ were dark and the straight tubules well defined. The cerebral dural vessels were congested and the spinal dural vessels were well defined. The bladder was found contracted. The blood gave no bands for methæmoglobin, but showed merely those of oxyhæmoglobin on spectroscopic examination.

Experiment No. 15.—Control experiments made by feeding water were negative, except when a large quantity (150 c. c.) of water was given to a rabbit weighing 1,020.5 grams. The animal died in 12 hours with marked pallor of the tissues (hydræmia), a pathological condition quite different from that obtained by feeding extracts of the loco plants, and no such results were secured with the amount of water used in our feeding experiments, 50 to 70 c. c.

SUBCUTANEOUS INJECTIONS.

Experiment No. 16.—On February 28, 1906, a white rabbit weighing 581.2 grams was injected subcutaneously at 10.35 a. m. with a concentrated aqueous extract of 83 grams of fresh *Astragalus mollissimus* collected in September, 1905, and preserved with chloroform. The temperature before injection was 102.1° F. At 1.40 p. m. the animal was dull; at 3.12 p. m. the temperature registered 99.8° F. The animal died during the night. The post-mortem examination was negative. Stomach pale; heart relaxed save left ventricle, which seemed contracted; dural vessels of the brain dilated; kidneys perhaps normal. No microscopical examination.

Experiment No. 17.—February 28, 1906, at 10.25 a. m., a guinea pig weighing 496 grams was injected subcutaneously with a concentrated aqueous extract of 83 grams of the fresh *Astragalus mollissimus* preserved in chloroform water. At 1.40 p. m. there was muscular twitching. The animal was dull and could be easily turned on his back. The hind legs began to show weakness. At 1.50 p. m. the hind legs were almost completely paralyzed and the animal could be easily turned on his back. Muscles of the limbs twitched and semen was expelled. Animal died at 2.15 p. m.

Post-mortem showed dural vessels of cord and brain full of blood. Stomach pinker than normal; mesenteric vessels dilated. Heart almost empty of blood. Kidneys congested.

SUMMARY OF FEEDING EXPERIMENTS ON RABBITS.

These experiments indicate that an acute form of poisoning may be induced by feeding concentrated aqueous extracts of *Astragalus mollissimus* and *Aragallus lamberti* from Hugo, Colo., and Imperial, Nebr., to rabbits, and that if the extract is given in smaller and repeated doses a more prolonged or chronic condition may follow.

The rabbits showing the chronic effects of these plants exhibit symptoms which have a marked parallelism with those reported as occurring in larger herbivora (horses and cattle) on the range when locoed; that is, the loss of appetite (Experiment No. 9), the emaciation and loss in weight (Experiment No. 9), the dullness and stupor, with more or less anesthesia (Experiment No. 7), the disturbance in the visual function (Experiment No. 9), and the mental symptoms (Experiment No. 6). The occasional abortion compares with what has been observed in larger animals. The dried *Astragalus molissimus* and *Aragallus lamberti* still retained their poisonous properties, as we were able to kill with aqueous extracts of the dried plants made in the laboratory under the proper conditions.

EXPERIMENTS ON SHEEP.

Experiment No. 1.—On May 31, 1906, a sheep weighing 32.2 kilos was fed with a concentrated aqueous extract of 1,000 grams of the fresh *Astragalus mollissimus* preserved in chloroform water. The temperature at 11 o'clock, the time of feeding, was 103.4° F. At 11.45 a. m. this dose was repeated. At 12 o'clock the temperature was 104.1° F. At 12.45 the animal urinated. At 1.10 p. m. a similar extract of 2,000 grams was fed. The total liquid used was 1,500 c. c. On June 1 no symptoms were noted. On June 5 an extract of 3,000 grams of fresh *Aragallus lamberti* and 3,000 grams of *Astragalus mollissimus* was fed. After feeding this the animal could be easily turned over on its back and its ear pricked with impunity. The animal at this time weighed 30.8 kilos. On June 6, at 11 a. m., the temperature was 104° F. The sheep had numerous soft stools, and was very dull, and would not eat. On June 7 the temperature was 103.7° F. and the sheep still refused to eat. On the 8th the temperature was 103.2° F. at 10.40 a .m., and the stools were still numerous and soft.

There were then fed 640 c. c., representing the aqueous extract of 4,000 grams of the fresh *Aragallus lamberti*. The animal could be easily turned on its back. It weighed at this time 28.57 kilos. On June 9, at 10.47 a. m., the temperature was 103.4° F. The sheep still did not eat, but had no diarrhea. It now weighed 27.9 kilos, and the temperature was 103° F. at 10.45 a. m.

On June 13 the animal began to eat, and 1,700 c. c. of fluid, representing 5,500 grams of the fresh *Aragallus lamberti*, were fed. The temperature at 12.30 p. m. was 103° F. On June 14 the temperature was 103.4° F., the animal weighed 28.3 kilos, and refused food. On June 16 the weight was 28.3 kilos; the temperature at 2 p. m. was 103.5° F. There was no diarrhea.

On June 19 the aqueous extract of 1,000 grams of the dried *Astragalus mollissimus* was fed with 420 c. c. of water. The temperature was 102.6° F. On June 20 the temperature was 102.9° F. at 10.45 a. m.

On June 21 500 c. c., representing the aqueous extract of 1,000 grams of the dried *Astragalus mollissimus*, were again fed. The animal now weighed 26.9 kilos. On June 26 the animal weighed 26 kilos, and its gait was very uncertain. The temperature was 104.2° F. It was fed 300 c. c. of fluid, representing the extract of 400 grams of the dried *Astragalus mollissimus*. On June 29 the animal weighed 26.8 kilos and the temperature was 102.8° F. It was fed the extract of 1,000 grams of dried *Astragalus mollissimus* in 500 c. c. of water. On June 30, at 10.45 a. m., the temperature was 104.2° F. The animal was very dull and died at night.

At autopsy the intestines and stomach merely appeared pale. There were no worms, and the lungs and other organs appeared normal.

Experiment No. 2.—A lamb weighing 15.4 kilos was fed on July 6, at 1.10 p. m., with 640 c. c. of fluid, representing the extract of 2,000 grams of *Astragalus mollissimus*. At 1.17 p. m. the animal could be turned on its back, and it regained its feet with difficulty. At 1.24 p. m. it urinated and had a stool. The lamb died during the night.

The autopsy the following morning showed the heart filled with clots; lungs normal save for hypostatic congestion. The cerebral and dural vessels were dilated. About 1½ teaspoonfuls of bloody serum were found at the base of the brain. There was none in the lateral ventricles, and no clots. The kidneys exhibited no marked congestion. There was no fluid found in the peritoneal or the pleural or pericardial cavities. The first stomach, however, contained small hemorrhagic spots, and the second was black. There were small hemorrhages in the intestines.

Experiment No. 3.—July 13, 1906, a sheep weighing 19.5 kilos was fed with 640 c. c. of fluid, representing the extract of 2,000 grams of *Aragallus lamberti*. The temperature at the time of feeding, 1.10 p. m., was 105.3° F. At 1.49 p. m. the sheep could be easily turned on its back. At 2.23 p. m. the temperature was 103.6° F. At 3.42 p. m. the temperature was 103.5° F. At 4.20 p. m. the respiration was fairly rapid. On July 14, at 11.15 a. m., the temperature was 103.6° F. The sheep would run about but could easily be turned over. It had not eaten, but there was diarrhea present. July 15, at 3.30 p. m., the temperature was 104° F. The animal had eaten. On July 17 the temperature was 104° F. and the animal weighed 18.8 kilos. On the 27th it weighed 17.2 kilos; on August 29, 20.8 kilos.

Experiment No. 4.—A lamb weighing 19 kilos was fed August 21, 1906, with 740 c. c., representing the aqueous extract of 2,500 grams of the fresh *Astragalus mollissimus*, shipped to Washington in September, 1905. This animal ate at night, but the following day was dull. When seen on August 27 there was diarrhea present and the animal was still dull. On the 28th the animal died, weighing 16.7 kilos. There was no autopsy on account of decomposition.

Experiment No. 5.—A lamb weighing 15.6 kilos was fed on September 4, 1906, with an aqueous extract representing 3,500 grams of the dried *Aragallus lamberti*, 1,000 c. c. of water being used. The temperature at the time of feeding was 104.3° F. At 2.48 p. m. the animal on rising to its feet developed a slight tremor of the fore legs and showed marked disinclination to stand on its feet. The temperature was 104° F. The animal died at 4.25 p. m. The post-mortem was negative, save for some reddening of the second stomach.[a]

These feeding experiments in sheep can not be considered quantitative, because, as is shown later, aqueous extracts of dried plants are often inactive, yet poisonous principles may be obtained from the plants by treatment with digestive fluids.

Extracts of dried loco plants vary much in their toxicity; with some the writer was unable to kill rabbits, even when an extract of 300 grams of the dried plant was used. It is interesting to note that when the field station was established at Hugo, Colo., in 1905, almost all the aqueous extracts of dried specimens sent to Washington would produce the acute symptoms of poisoning in rabbits, but during the third season of its existence many of the samples sent from the same area were much less active, if not inactive.

LABORATORY EXPERIMENTS—CHEMICAL.

The fact that the aqueous extract of 500 grams of the fresh *Astragalus mollissimus*, or of 200 grams (in some cases 100 grams) of the dried plant, when fed by mouth, would regularly kill a rabbit weighing about 907 grams, with certain definite clinical symptoms and pathological lesions, was at first arbitrarily selected as our test to aid in the isolation of the active principle. Later the production of chronic symptoms by the aqueous extract or digestion of 200 grams of these dried plants given in doses of 100 grams each on two successive days was considered essential. Carnivora, such as dogs and cats, vomit so easily as to render them unsuitable for these investigations. The aqueous extract was distilled with and without steam, also after acidifying with sulphuric acid, and likewise after the addition of magnesium oxid, but in all cases the distillate was inactive.

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[a] There was a slight odor of chloroform noticed on opening the stomach, so that perhaps the imperfect removal of the chloroform due to a hurried evaporation of the extract should be taken into consideration in this case.

The concentrated aqueous extract was shaken by the Dragendorff method with petroleum ether, benzol, chloroform, ether, and amyl alcohol, both in alkaline and acid condition, but the shakings yielded no physiologically active body. Shakings by the Otto-Stas method also proved inactive. Lead acetate, lead subacetate, silver nitrate, mercuric chlorid, alcohol, phosphotungstic acid, trichloracetic acid, ammonium hydrate, sodium carbonate, sodium hydrate, Mayer's solution, uranyl acetate, silver oxid, and barium carbonate also failed to remove the active constituent. They gave heavy precipitates in all cases, but these proved inactive. Hydrocyanic acid was sought for with negative results. The pathological lesions in the very acute cases suggested in some respects oxalic acid, a saponin, a metal, or perhaps a toxalbumin as the active principle, but none of the precipitants for saponins, such as lead and copper, or the magnesium oxid method yielded a body which was active. Proteids were excluded by the fact that the various proteid precipitants—alcohol, trichloracetic acid, lead subacetate, mercuric sulphate or chlorid, and salting out with ammonium sulphate and sodium chlorid (complete saturation and half saturation)—failed to give an active precipitate. Glucosidal or alkaloidal bodies were also excluded. On dialysing for twenty-four hours, some of the active principle went into the dialysate and some remained in the dialyser. Ether yielded a precipitate from alcoholic solution which failed to kill. The possibility of the activity of the plants being due to its normal acidity was excluded by neutralizing the extract with sodium hydrate and precipitating the salts with alcohol. The filtrate proved active after removing the alcohol.

The negative results in looking for active alkaloidal, or glucosidal, or proteid bodies suggested that perhaps the action was due to some inorganic constituent. The writer then boiled the extract three minutes and as the filtrate was still found active and the proteid precipitate inactive became convinced of the inorganic nature of the active constituents, and finally incinerated the plant. The acid extract from this was also active, but death was delayed several hours. This was believed to be due to the insoluble form into which the compound was converted.[a] In fact, the question of solubility and the avoidance of an acid reaction, which of itself may kill, are the main points to keep in mind.

These experiments indicated that the injurious action toward rabbits of the *Astragalus mollissimus* and *Aragallus lamberti* collected at Hugo, Colo., was due to one or more inorganic constituents,[b] but it does not follow that all loco plants have the same poisonous principle nor that the same species occurring on all soils has the same poisonous action.[c]

Of *Astragalus mollissimus* from Imperial, Nebr., collected in 1906, 200 grams were ashed in a platinum bowl and extracted with water. This aqueous extract when neutralized produced no marked symptoms in a rabbit and the weight of the animal remained about the same.

The ash undissolved after this extraction was then treated with acetic acid and water overnight, and after carefully evaporating off the acetic acid on the bath (tested by litmus paper) the residue was fed, partly in solution and partly suspended in water, to a rabbit weighing 1,800.2 grams. Next day the rabbit weighed 1,771.8 grams, showed paralysis of the limbs, and died during the morning. The stomach was intensely reddened and contracted.

An extract of a similar ash was made by boiling the same amount with a large quantity of 94 per cent alcohol. This was evaporated in vacuo and taken in water and fed to a rabbit weighing 1,459.9 grams. On the sixth day the animal died, having lost 70.9 grams in weight. The stomach showed reddening but no ulcers.

An acetic acid aqueous extract, made from the ash after the alcoholic extraction, proved inactive, showing that the alcohol had removed the active bodies. A 70 per cent alcohol extract of another ashed lot proved active, killing the rabbit overnight.

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[a] Work is now being done by the writer on the inorganic constituents of various plants.

[b] Scattered throughout the veterinary literature one finds cases of poisoning in animals with symptoms similar to those occurring in locoed animals which are attributed to eating plants grown on a peculiar soil, as in Oserow, Ueber Krankh. d. Pferde, welche Aehnlichkeit mit der Cerebro-spinal meningitis haben, aber durch Vergiftungen mit Gräsern von Salzgründen (Salzmooren) verursacht werden, Journ. f. Allgem. Veterinär-Medicin, St. Petersburg, p. 486, 1906. Abstract in Jahresber. über d. Leistungen auf dem Gebiete d. Veterinär-Medicin, vol. 26, p. 226, 1906.—Compare also Étude sur Quelques Plantes Vénéneuses des Regions Calcaires, Bul. Soc. Cent. de Méd. Vét., vol. 48, p. 378. 1894.

[c] After completing this work the writer found that Sayre had said that he "had the suggestion that the harm coming from this plant is due to the inorganic constituents; this clue has been followed up, but like the others has brought us no nearer to the solution of the problem." Kans. Acad. Sci. Trans., vol. 18, p. 144. 1903.

Of *Astragalus mollissimus* from Imperial, Nebr., 200 grams were ashed in a platinum bowl and the ash treated with acetic acid water. After freeing from acid, one half of the solution and emulsion was fed one day and the second half fed the following day. The rabbit at the time of feeding weighed 1,275.7 grams. Fourteen days later the animal died, weighing 1,105.6 grams. No autopsy.

A similar extract of the ash from between 100 and 150 grams of the same dried plant produced death in a rabbit weighing 1,190 grams in two hours and fifty-eight minutes.

The acetic acid extract of the ash of 125 grams of a mixture of the dried *Astragalus mollissimus* and *Aragallus lamberti* received from Hugo, Colo., June, 1907, after freeing from acid, was fed to a rabbit weighing 1,304 grams on July 29. On July 30 it weighed 1,332.4 grams. August 1 it weighed 1,219 grams, and it died the same day. The stomach was reddened and showed ulcers.

A similar extract from 250 grams of the same dried plants on boiling gave a heavy precipitate, but this precipitate was inactive, while the filtrate killed a rabbit in four hours.

Of dry *Aragallus lamberti* collected in September, 1906, 200 grams were extracted with water and fed to a rabbit weighing 1,516.7 grams. Two days later the animal weighed 1,360 grams and died the same day.

The ash from 200 grams of the same dried plant was extracted with acetic acid, and after evaporating off the acid this was fed to a rabbit weighing 2,045.3 grams. Seven days later the animal weighed 1,729.3 grams, having lost 316 grams in weight.

The ash from 250 grams of the same species of plant, after similar treatment with acetic acid, induced death in a rabbit weighing 2,069 grams in 2 hours and 20 minutes. The stomach was inflamed.

EFFECT OF THE AQUEOUS EXTRACT OF ASHED LOCO PLANTS.

The filtrate from the ash from 200 grams of dried *Astragalus mollissimus*, from Imperial, Nebr., after similar treatment with acetic acid water and freed from free acid, killed a rabbit in several hours.

Hydrochloric acid also rendered the toxic agent of the ash soluble in water, but proved unsuitable for our work, as it was found impossible to obtain neutral residues by mere evaporation on the bath. At first one of the heavy metals or members of the H_2S group[a] was suspected, but on passing H_2S into the slightly acid extract of the ash no active precipitate resulted, but the filtrate remained active.[a] A special Marsh test was, however, made for arsenic and antimony with negative results. A test for tungsten with zinc and hydrochloric acid proved negative.

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[a] Swain, R. E., and Harkins, W. D. Arsenic in Vegetation Exposed to Smelter Smoke. Journ. Amer. Chem. Soc., vol. 30, p. 915. 1908.—Harkins, W. D., and Swain, R. E. The Chronic Arsenical Poisoning of Herbivorous Animals. Journ. Amer. Chem. Soc., vol. 30, p. 928, 1908.

Members of the ammonium sulphid group were then suspected, but while ammonium hydrate alone gave a heavy white precipitate, this precipitate, as also the black one with ammonium sulphid, proved inactive save when not thoroughly freed from acid (used for solution). The action of this ammonium sulphid precipitate on rabbits was watched for sixteen days, but without result. Nevertheless, the writer still suspected some of the rare earths.[b]

Sestini[c] had found that if certain plants were nourished with a solution of a beryllium salt, in the ash of these plants could be shown the presence of beryllium.

Two grams of beryllium chlorid were fed in aqueous solution to a rabbit weighing 1,800.2 grams. In four days this animal lost 241 grams and died. The stomach showed the same general pallor seen in chronic locoed rabbits, but no ulcers. The tests for beryllium by Sestini's method, however, failed to show beryllium in the active loco plants examined.

Thorium chlorid, cerium chlorid, and lanthanum chlorid in 2-gram doses and zirconium chlorid in 3-gram doses produced no chronic symptoms in rabbits or, in fact, any disturbance. Titanium chlorid, 2.5 grams, evaporated in the air and then fed in an emulsion to a rabbit, also proved inactive, but this inactivity may have been due to its insolubility.

Thallium nitrate c. p., in aqueous solution, in 2-gram doses, killed a rabbit weighing 2,154.6 grams in two hours and fifteen minutes. The stomach in this case, while pink, was not hemorrhagic.

Zirconium chlorid has an astringent taste, and if fed repeatedly will cause the metallic astringent action. On boiling an acetic acid solution of the ash with sodium acetate a precipitate formed.[d]

The presence of zirconium was thus suspected and Dr. E. C. Sullivan, of the United States Geological Survey, estimated it to be present in the ash of a sample of *Aragallus lamberti* in about 0.01 per cent zirconium oxid, with also 0.1 per cent titanium dioxid.[a]

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[a] A similar extract was sent to the Bureau of Chemistry, and that Bureau also reported an absence of the elements of the H_2S group.

[b] Bachem, C. Pharmakologisches über einige Edelerden. Arch. Internat. de Pharmacodyn., vol. 17, p. 363. 1907.

[c] Sestini, F. Esper. di Vegetaz. del Frumento con Sostituz. della Glucina alla Magnesia. Staz. Sper. Agrar. Ital., vol. 20, p. 256. 1891.—Di alcuni Elementi Chimici Rari a Trovarsi nei Vegetabili. Staz. Sper. Agrar. Ital., vol. 15, p. 290. 1888.

NOTE.—The ammonium sulphid precipitate was very small if the phosphates were first removed with tin and nitric acid.

[d] Böhm, C. R. Darstellung d. seltenen Erden, vol. 1, p. 40. 1905.

Zirconium chlorid, 3 grams, was fed in aqueous solution to a rabbit weighing 850.5 grams. This rabbit lost 96 grams in seven days, and was then fed 3 grams more of the same solution and the following day 2 grams more. It died eight days later, weighing 656 grams. The stomach and intestines were contracted, but showed no ulcers. However, 4 grams killed a rabbit in two hours and thirty-two minutes.

The filtrate, after treating an active solution of the ash with hydrogen peroxid, proved active, thus showing that zirconium was not entirely responsible for the poisonous action.

Yttrium, while not found in the plant, was administered as yttrium chlorid to a rabbit weighing 1,530 grams in 2-gram doses in solution. This animal gained 113.4 grams in five days.

Didymium chlorid c. p., in 3-gram doses, was fed to a rabbit weighing 1,020 grams. This rabbit lost 70 grams in four days.

The administration of manganese acetate[b] in 2-gram doses was followed by a gain in weight of a rabbit of 42.5 grams, while a dose of 3 grams killed a rabbit weighing 1,077 grams in two hours and thirty minutes. Wohlwill[c] has emphasized the fact that the members of the iron group owe their comparative harmlessness to not being absorbed by the gastro-intestinal tract.

No zinc was found in the plant.[d]

It is well recognized that potassium salts given hypodermically are decidedly toxic and that ammonium salts given per os will kill, so that the writer considered the possibility of other members of the group being responsible for the injurious action. The fact that the alkaline distillate of the plant proved inactive eliminated the ammonium salts.

Cæsium chlorid c. p., 2 grams, was fed in aqueous solution to a rabbit weighing 1,077.2 grams. In six days this animal lost 255 grams in weight, when it died.[e]

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[a] Wait, C. E. Occurrence of Titanium. Journ. Amer. Chem. Soc., vol. 18, p. 402. 1896.

NOTE.—There seem to be no records of any study of the pharmacological action of titanium.

[b] Compare Jaksch, R. v. Ueber Mangantoxikosen und Manganophobie. Münch. Med. Woch., p. 969. 1907.

[c] Wohlwill, F. Ueber d. Wirkung d. Metalle d. Nickelgruppe. Arch. f. Exper. Path., vol. 56, p. 409. 1907.

[d] Laband, L. Zur Verbreitung des Zinkes im Pflanzenreiche. Zeits. f. Untersuch. d. Nahrungs- u. Genussmittel, vol. 4, p. 489. 1901.

[e] Cæsium occurs in various plants and the possibility of poisoning by this element must be considered. It is hoped that the writer may be able to undertake a more thorough pharmacological study of this element.

A second rabbit, weighing 1,020.5 grams, was fed with 2 grams of the same solution and lost 368 grams in twenty-one days. The spectroscopic test, however, failed to show cæsium in the ashed plant. Rubidum chlorid c. p., in 2-gram doses, proved inactive. The platinum chlorid precipitate from the extract of the plant proved inactive.

The fact that the filtrate after precipitation of the phosphates by tin and nitric acid and H_2S was active excluded the phosphoric acid radical, and the filtrate after treatment with $BaCO_3$ and AgO being active excluded the H_2SO_4 and HCl radicals as the toxic body. Fluorine was proved to be absent.

A radio-active substance was suspected, but Dr. L. J. Briggs, Physicist of Bureau of Plant Industry, reported that the dried plant showed no special amount of radio-activity.[a]

Power and Cambier, Sayre, and Kennedy had previously called attention to the abundance of calcium in the plant, and the writer's investigations confirm this. Pharmacologists are averse to believing calcium given per os poisonous. The writer has, however, fed 5 grams of the acetate of calcium in solution to a rabbit weighing 652 grams. This animal died in two hours, with marked irritation of the stomach, the result being due to the so-called "salt action." Much larger amounts were fed in divided doses, but without injury. Calcium phosphate and calcium sulphate in 2-gram doses proved harmless to a rabbit weighing about 1,400 grams. Three grams of magnesium acetate[b] were fed in solution for five successive days to a rabbit weighing 1,417 grams, but without apparent effect.

Strontium acetate c. p., in 2-gram doses, likewise caused no disturbance.[c] No strontium in any amount recognizable by chemical tests was proved in the plant. So that by a process of exclusion the writer was forced to think of barium as the main cause of the trouble.

The writer noted that if the ashed plant was extracted with H_2SO_4 water and this extract freed from sulphuric acid with $PbCO_3$ and H_2S the solution proved inactive to rabbits and also that after this extraction the acetic acid extract of the ash failed to kill. In other words, the sulphate of our body was insoluble in water. At times in passing H_2S into active solutions of the ashed plant freed from the acetic acid by evaporation the filtrate and likewise the precipitate were inactive. Noyes and Bray [a] have noted that if H_2S is passed into certain solutions in the presence of an oxydizing agent, such as ferric iron, H_2SO_4 would be formed, which would throw any barium out of solution.

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[a] Acqua, C. Sull'accumulo di Sostanze Radioattive nei Vegetali. Atti della Reale Accad. dei Lincei, 5 s, vol. 16, sem. 2, p. 357. 1907.

[b] Compare Meltzer, S. J. Toxicity of Magnesium Nitrate When Given by Mouth. Science, vol. 26, p. 473. 1907.

[c] Burgassi, G. Modificaz. del Ricambio per Azione dello Stronzio. Archiv. di Farmacol., vol. 6, p. 551. 1907.

In one blood-pressure record made with a dog (vagi nerves cut), a rise in blood pressure (a characteristic physiological action of barium) was seen to follow the intravenous injection of the aqueous extract of the plant, in spite of its normal acid reaction.

Accidentally the writer found that Sprengel [b] had reported the presence of barium in *Astragalus exscapus*, a closely allied plant. Barium has also been found in the vegetable world by Scheele in 1788, and later by Eckard,[c] who found it in beech, while Forchhammer [d] proved it in birch, and Lutterkorth found it in the soil of the same area in which Eckard worked. Dworzak [e] noted the occurrence of traces of this element in wheat grown along the Nile, and Knop [f] found it in the soil. Doctor Balfour, of Khartum, Egypt, informed the writer that he knew of no cases in which this barium in wheat had produced poisoning. Hornberger [g] found barium both in the red beech grown in Germany and in the soil on which these trees grew. It has also been claimed that various marine plants may take up barium from the sea.[h]

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[a] Noyes, A. A., and Bray, W. C. System of Qualitative Analysis for the Common Elements. Journ. Amer. Chem. Soc., vol. 29, pp. 168, 172, and 191. 1907.

NOTE.—Barium sulphate is nontoxic on account of its insolubility. Orfila fed 16–24 grams to dogs without causing any disturbance. Bary, A. Beitr. z. Baryumwirkung. Dorpat, 1888, p. 25.

[b] Sprengel, C. Von den Substanzen der Ackerbrume und des Untergrundes. Journ. f. Techn. u. Œkon. Chem., vol. 3, p. 313. 1828.

[c] Eckard, G. E. Baryt, ein Bestandtheil der Asche des Buchenholzes. Annal. der Chem. u. Pharm., n. s., vol. 23, p. 294. 1856.

[d] Forchhammer, J. G. Ueber den Einfluss des Kochsalzes auf die Bildung der Mineralien. Annal. d. Physik u. Chemie, vol. 5, p. 91. 1905.—Lutterkorth, H. Kohlensäurer Baryt, ein Bestandtheil des Sandsteines in der Gegend von Göttingen. Annal. d. Chem. u. Pharm., n. s., vol. 23, p. 296. 1856.

[e] Dworzak, H. Baryt unter den Aschenbestandtheilen des Ægyptischen Weizen. Landw. Versuchs.-Stat., vol. 17, p. 398. 1874.

[f] Knop, W. Analysen von Nilabsatz. Landw. Versuchs.-Stat., vol. 17, p. 65. 1874.—Compare also Demoussy, E., Absorption par les Plantes de Quelques Sels Solubles, Thése, Paris, 1899.—Knop, W., Einige neue Resultate der Untersuchung über die Ernährung der Pflanze, Ber. ü. Verhandl. d. königl. sächs. Gesells. d. Wissens. zu Leipzig, Math. Phys. Cl., vol. 29, p. 113, 1877.—Suzuki, U., Can Strontium and Barium Replace Calcium in Phænogams? Bul. Coll. Agric. Tokio Imp. Univ., vol. 4, p. 69, 1900–1902.

[g] Hornberger, R. Ueber d. Vorkommen d. Baryums in d. Pflanze und im Boden. Landw. Versuchs.-Stat., vol. 51, p. 473. 1899.

[h] Roscoe, H. E., and Schorlemmer, C. Treatise on Chemistry, vol. 2, p. 455. 1897.

Hillebrand[a] has called attention to the fact that the igneous rocks of the Rocky Mountains showed a higher percentage of barium than rock from other portions of the United States, so that under these conditions one might expect the presence of barium in plants growing in this region. A sample of *Aragallus lamberti* and one of *Astragalus mollissimus* were sent to the Bureau of Chemistry for spectroscopic examination for various elements and they reported traces of barium in each.[b]

With these arguments the writer felt sure of the presence of barium, and the matter was discussed with Dr. E. C. Sullivan, of the United States Geological Survey, and he kindly corroborated the conclusions reached as to the presence of barium, controlling its presence by means of the spectroscope, and estimated it roughly as 0.1 per cent BaO in the ash of a sample of *Aragallus lamberti* (6.3 milligrams $BaSO_4$ in 4 grams ash). This determination was made by Hillebrand's method.

Kobert has anticipated this result, saying that "all plants are in the position occasionally to take up barium combinations from the soil," and "the plants which thus contain barium may act injuriously to men and animals."[c]

TOTAL ASH DETERMINATIONS OF LOCO PLANTS.

The reports of the ash analyses of the loco plants show marked variations in the total amount of the ash. Thus, from *Aragallus lamberti* Dyrenforth obtained 4.32 per cent and O'Brine 13.52 per cent of ash. The Bureau of Chemistry analyzed two different samples of this dried plant and reported in one case 11.15 per cent and in the second 11.64 per cent of ash. O'Brine[d] obtained 13.52

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[a] Hillebrand, W. F. Analysis of Silicate and Carbonate Rocks. Dept. Interior, U. S. Geol. Survey, Bul. 305, p. 18. 1907.

[b] This report came from the Plant Analysis Laboratory of the Bureau of Chemistry, a different one from that which later controlled the writer's tests quantitatively and qualitatively. In other words, the conclusions of the writer as to the presence of barium were controlled by three separate individuals.

[c] Kobert, R. Kann ein in einem Pflanzenpulver gefundener abnorm höher Barytgehalt erklärt werden durch direkte Aufnahme von Baryumsalze durch die lebende Pflanze aus dem Boden? Chem. Zeit., vol. 10, p. 491. 1899.

NOTE.—The writer has also found barium in entirely different botanical families from the loco weed, and it is hoped a report can shortly be made of some of these.

NOTE.—The first sample of ash analyzed by the Bureau of Chemistry had 0.21 per cent Fe_2O_3, 0.92 per cent Al_2O_3, 0.98 per cent CaO, 0.37 per cent MgO, 5.50 per cent SiO_2. The second lot was only examined for certain constituents, and gave K_2O, 2.25 per cent; CaO, 1.20 per cent; MgO, 0.41 per cent; P_2O_5, 0.52 per cent; and SO_3, 0.24 per cent.

[d] The detailed analysis of O'Brine can be found on page 32 of this report.

per cent of ash from the same species. The writer's analysis[a] gave in one sample of *Aragallus lamberti*, collected at Hugo, Colo., in 1907, 18.8 per cent of ash; a second lot (1907), 12.44 per cent; a third (1906), 11 per cent, and a fourth (May, 1905) gave 37.3 per cent of ash.[b] One lot from Woodland Park, Colo. (October, 1906), gave 6.4 per cent. One lot from Hugo, Colo. (October, 1907), yielded 9.6 per cent.

In the case of *Astragalus mollissimus*, Wentz obtained 6.76 per cent, Sayre 12.01 per cent, Kennedy 20 per cent, O'Brine 12.15 per cent, while the sample analyzed by the Bureau of Chemistry gave 18.4 per cent of ash. One sample from Kit Carson County, Colo. (December, 1906), which proved inactive physiologically, gave an ash content of 6.9 per cent. A sample of *Astragalus missouriensis* collected at Hugo, Colo., June, 1907, yielded an ash content of 21.8 per cent, and an *Astragalus missouriensis* collected at Pierre, S. Dak., September, 1907, yielded 27 per cent. An *Astragalus nitidus* from Custer, S. Dak. (July, 1907), gave 5.2 per cent ash, while an *Astragalus nitidus* collected at Woodland Park, Colo., in October, 1906, yielded 7.8 per cent, and another specimen of *Astragalus nitidus* also collected at Woodland Park, Colo., in October, 1907, gave 12.2 per cent. An *Astragalus drummondii* from Custer, S. Dak. (July, 1907), gave 5.9 per cent. *Astragalus pectinatus* (Hugo, June, 1907) yielded 6.1 per cent. A fresh (undried) specimen of *Astragalus mollissimus* (unknown origin, November, 1907) yielded 3.8 per cent of ash. One sample of *Astragalus decumbens* (Ephraim, Utah, August, 1907) gave 21.8 per cent of ash.

These determinations must necessarily be only approximate, as the plants were collected by different persons who exercised different degrees of care in freeing them from adherent soil, and possibly in drying the plants, so that the main value of these figures is their aid in determining the amount of barium present.

BARIUM DETERMINATIONS IN THE ASH OF LOCO PLANTS.

Attention has been called to the fact that in ashing plants containing barium a part at least of this barium is converted into the insoluble sulphate and a part into the carbonate, so that the characteristic pharmacological action of the ash will depend not upon the total barium present, but upon the form in which it occurs—little action if much $BaSO_4$ and more complete if more $BaCO_3$ results. A further difficulty in the recognition of barium in plants is due to the fact that certain inorganic salts interfere with the precipitation by H_2SO_4.

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[a] All ash and barium determinations were made from the dried plants save when otherwise specified.

[b] Evidently these plants must have been imperfectly freed from soil.

A specimen of *Aragallus lamberti* (Hugo, summer of 1907) with 12.44 per cent of ash was examined for its barium content by Hillebrand's method.[a] The method was as follows:

Two grams of the ash were first fused with sodium carbonate and the fused mass washed with water containing sodium carbonate. The residue was washed into a beaker and treated with a few drops of sulphuric acid. The residue now remaining was filtered and after ignition was treated with hydrofluoric and sulphuric acids. After evaporating off these acids, the residue was treated with sulphuric acid water, filtered, and then fused with sodium carbonate. After extracting with sodium carbonate water, the residue was dissolved in just enough hydrochloric acid and precipitated with sulphuric acid. The precipitate was dissolved in concentrated sulphuric acid and reprecipitated by water and weighed as $BaSO_4$.[b] So far as the writer can ascertain, there have been no control experiments made for this method to determine the experimental error.

Of the above ash, 1.998 grams gave 5.2 milligrams of $BaSO_4$, which would correspond to 75.75 milligrams of barium acetate crystals—$Ba(C_2H_3O_2)_2+H_2O$—in 200 grams of the dried plant. The residue by the Hillebrand method after weighing was tested with the spectroscope and gave a bright spectrum for barium. The same ash was analyzed by the Bureau of Chemistry, using a shorter method, and they reported 2.7 milligrams of barium sulphate in 1.1217 grams of ash. A second sample collected earlier in the summer, with an ash content of 18.6 per cent, was shown to yield barium corresponding to 3.4 milligrams of $BaSO_4$ in 2.5 grams of the ash.[c]

One lot of *Aragallus lamberti* collected at Hugo, Colo., in May, 1905, and which gave an ash content of 37.3 per cent, was found to yield 3 milligrams of $BaSO_4$ from 1.998 grams of ash, or 173.88 milligrams of $Ba(C_2H_3O_2)_2+H_2O$ in 200 grams of the dried plant, but this ash also contained 0.27 per cent of SO_3. The Bureau of Chemistry reported the barium to correspond to 2.9 milligrams of $BaSO_4$ in 2.45 grams of the ash.

The *Astragalus missouriensis* (Hugo, June, 1907), with an ash content of 21.8 per cent, gave 3 milligrams of $BaSO_4$ in 2.01 grams of ash, or 76.58 milligrams of $Ba(C_2H_3O_2)_2+H_2O$ in 200 grams of the dried plant. The residue after weighing was tested spectroscopically and gave a bright barium spectrum.

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[a] Hillebrand, W. F. Analysis of Silicate and Carbonate Rocks. U. S. Geol. Surv. Bul. 305, p. 116. 1907. See also Folin, O., On the Reduction of Barium Sulphate in Ordinary Gravimetric Determinations, in Journ. Biol. Chem., vol. 3, p. 81. 1907.

[b] All the determinations of barium which resulted either positively or negatively were made with the same bottle of sodium carbonate and H_2SO_4, so that impurities in the chemicals were thus eliminated.

[c] Report from Bureau of Chemistry.

The *Astragalus drummondii* from Custer, S. Dak. (1906), *Astragalus mollissimus* from Kit Carson County, Colo. (December, 1906), and *Astragalus nitidus* from Woodland Park, Colo. (October, 1907), were reported by the Bureau of Chemistry to contain no barium.

The ash of the *Astragalus pectinatus* (Hugo, June, 1907) was reported by the Bureau of Chemistry to show no barium on spectroscopic examination.

Two grams of active loco plant ash yielded from 5 to 6 milligrams of $BaSO_4$, but it can be easily seen that in multiplying this amount to correspond to 200 grams of the dried plant errors would be likely to arise, so that the whole amount of barium would not necessarily be accounted for.

ANALYSIS OF SOILS.

One sample of the soil from near Hugo, Colo., from which the *Aragallus lamberti* was collected, was examined by the Bureau of Soils, and that Bureau reported the absence of barium and zirconium, at least of any recognizable by the chemical methods used, so that it can not be said that the barium came from any soil accidentally mixed with the ash. Traces of titanium were, however, found. Evidently the plant must collect minimal quantities of these elements from the soil and store them.

The water from a well of an adjacent area was examined by the Bureau of Chemistry and reported to contain 37.4 parts of calcium and 13.7 parts of magnesium in one million, and that the water contained no barium.[a]

FEEDING EXPERIMENTS WITH BARIUM SALTS ON ANIMALS IN THE LABORATORY.

On these figures the writer took 0.2 gram of crystallized barium acetate c. p., using the acetate because acetic acid has been proved in certain loco plants by Power and Cambier, and after dissolving it in water fed it at 9.45 a. m. to a rabbit weighing 1.177 grams. The head soon fell forward so that the nose rested on the ground. At 10.58 a. m. the rabbit seemed unable to guide itself and would run into obstructions if forced to move. There was no diarrhea but it urinated several times. There was a peculiar tremor of the muscles noted. The animal would not startle by sudden noises and at 11.06

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[a] Barium has been found in well water in England. See Thorpe, T. E., Contribution to the History of the Old Sulphur Well, Harrogate, in Philos. Mag., 5 s., vol. 2, p. 50, 1876.

a. m. could be placed on its back with ease. The pupils appeared about normal. The whites of the eyes showed very prominently. At 11.35 a. m. the fore legs were paralyzed. The following morning the animal was dead, its weight being 1,120 grams. The heart was dilated; the stomach was not hemorrhagic, but rather pale.

A second rabbit, which weighed 1,630 grams, was fed with a solution of 0.5 gram of the same salt at 9.42 a. m. At 10.35 a. m. the animal passed soft stools and showed a marked disinclination to move, with evidence of pain. The diarrhea [a] became more marked and the animal's hind quarters were soiled with feces. At 10.48 a. m. there was marked incoordination of the limbs and inability to stand. Finally, at 10.56 a. m., convulsions began and the animal died at 11.02 a. m. The autopsy was made about two hours later. The animal was then rigid. The kidneys seemed rather congested. The intestines were relaxed; mesenteric vessels dilated. The pyloric region of the stomach appeared hemorrhagic.

A third rabbit, fed like the preceding with 0.5 gram of barium acetate, showed much the same result. In this case there was some retching, but the other symptoms were as above, the animal dying in one hour and five minutes. No hemorrhages were seen in the stomach walls. It was noted that after the administration of certain doses, 0.2 gram, there was no diarrhea.

On September 23, 1907, a rabbit weighing 1,757 grams was fed at 10.42 a. m. with 0.1 gram of the same barium acetate. The temperature at the time of feeding was 102.9° F. At 12.05 a. m. the animal urinated. Temperature, 101.4° F. On September 24 the animal weighed the same. Temperature at 10.55 a. m., 102.3° F. The same amount of barium was fed. At 3.40 p. m. the temperature was 102.5° F. On September 25 the animal weighed 1,800 grams. Temperature, 102.2° F. at 10.39 a. m. The dose of barium was repeated. At 3.55 p. m. the temperature was 101.4° F. On September 26 at 9.38 a. m. the temperature was 101.1° F., and again the barium was given. At 3.57 p. m. the temperature was 101.5° F. On September

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[a] Magnus, R. Wirkungsweise u. Angriffspunkt einiger Gifte am Katzendarm. Archiv. f. Gesam. Physiol., vol. 108, p. 44, 1905.

NOTE.—Reports on the histological changes in acute barium poisoning can be found in Pilliet, A., and Malbec, A. Note sur les Lesions Histologiques du Rein Produits par les Sels de Baryte sur les Animaux. Comp. Rend. Hebd. Soc. de Biol., vol. 4, p. 957. 1892.

Literature on the pharmacology of barium not otherwise referred to is as follows: Boehm, R. Ueber d. Wirkungen d. Barytsalze auf d. Thierkörper. Arch. f. Exp. Path., vol. 3, p. 217. 1875.—Sommer, F. Beitr. z. Kennt. d. Baryum-Vergiftung. Dissert., Würzburg, 1890.—Neumann, J. Ueber den Verbleib der in den thierischen Organismus eingeführten Bariumsalzen. Archiv. f. Gesam. Physiol., vol. 36, p. 576. 1885.—Hefftner, A. Ausscheidung körperfremder Substanzen im Harn, Ergeb. d. Physiol., pt. 1, p. 121. 1903.—

27 the rabbit weighed 1,772 grams. The temperature at 9.53 a. m. was 102.3° F. The barium was fed for the fifth time. At 10.27 a. m. there were general convulsions. The eyes teared. At 10.32 a. m. soft stools appeared and the animal urinated. Stools were passed at various periods. At 11.30 a. m. there were no signs of pain on pinching the ear. At 11.58 a. m. the animal retched. The animal was lying with the fore legs wide apart and could not support itself. At 12.05 p. m. the temperature was 98° F. and the rabbit died shortly after.

The peritoneal cavity seemed normal. The small intestines were relaxed, while the mesenteric vessels were dilated. The kidneys seemed congested. The stomach walls were pink and in places covered with mucus. The heart was relaxed save the left ventricle, which seemed firm.

On September 23, 1907, a second rabbit, weighing 1,360 grams, was fed with a similar solution and the feeding was repeated at the same time the first rabbit was fed. On September 27 the animal weighed 1,416 grams. On this day a peculiar movement of the hind legs on jumping appeared, apparently due to an inability to draw the legs completely up, and the fore legs were spread wide apart, as if too weak to support the animal. The temperature had also fallen. On September 28 the animal had apparently recovered. Weight, 1,516 grams on October 21.

On September 23, 1907, a third rabbit, weighing 1,304 grams, was fed with 50 milligrams of barium acetate. This dose was repeated each time the other two rabbits were fed. On September 27 it weighed 1,304 grams. Marked muscular twitching appeared, with disinclination to move. Finally there were convulsions and paralysis of the limbs. No stools were seen. This animal lay quiet all night,

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Binet, P. Recherches Compar. sur l'Action Physiol. des Métaux Alcalins et Alcalino-terreux. Rev. Méd. de la Suisse Romande, vol. 12, pp. 535, 607. 1892.—Cyon, M. Ueber d. toxisch. Wirkung. d. Baryt- u. Oxalsäureverbindungen. Archiv. f. Anat., Physiol. u. Wissens. Med., 1866, p. 196.—Mickwitz, L. Vergleich. Untersuch. ü. d. physiol. Wirkung d. Salze d. Alcalien u. Alcal. Erden. Dissert., Dorpat, 1874.—Heilborn, F. Ueber Veränderungen im Darme nach Vergift. mit Arsen, Chlorbarium und Phosphor. Dissert., Würzburg, 1891.—Reincke, J. J. Ein Fall mehrfacher Vergiftung durch kohlensäuren Baryt. Viertelj. f. gerichtl. Med., n. s., vol. 28, p. 248. 1878.—Orfila, Mémoire sur l'Empoisonnement par les Alcalis Fixes. Journ. de Chimie Méd., 2 s., vol. 8, p. 200. 1842.—Santi, L. Se nel Veneficio per Sali di Bario questo Metallo passa alla Urina? Gazz. Chem. Ital., vol. 33, pt. 2, p. 202. 1903.—Weber, F. R. Barium Chloride. Milwaukee Med. Journ., vol. 12, pp. 39, 60. 1904.—Rabuteau. De l'Innocuité des Sels de Strontium Comparée a l'Activité du Chlorure de Baryum. Gaz. Méd. de Paris, 3 s., vol. 24, p. 218. 1869.—The very early literature is considered in detail by Bary.

apparently unable to move, and continued on its side until 3.15 p. m. on September 28, when it gradually recovered, weighing 1,345 grams on October 24.

On October 24, 1907, a rabbit weighing 1,346.5 grams was fed with a solution of 25 milligrams of crystallized barium acetate. On the next day the weight was 1,318 grams, and the dose was repeated. On October 26 it weighed 1,275.7 grams, and the dose was repeated; on October 30 it weighed 1,332 grams, and on October 31 its weight was 1,375 grams. The animal died at night on November 6; weight, 1,134 grams. The post-mortem examination, made with Dr. Meade Bolton, of the Bureau of Animal Industry, was negative save for the presence of necrotic tissue in one enlarged thyroid.

On October 24, 1907, a rabbit weighing 1,332 grams was fed with a solution of 25 milligrams of crystallized barium acetate. On the next day the animal weighed the same, and the dose was repeated. On October 26 it weighed 1,289 grams, and the same amount of barium was given. On October 28 the weight was 1,219 grams and two days later 1,289 grams.

On October 31, 1907, a rabbit weighing 723 grams was fed with a solution of 25 milligrams of barium acetate. This rabbit was fed in all nine times during a period of ten days. At the end of this time it weighed 779 grams and died six days later, weighing 723 grams. The post-mortem was negative.

A rabbit weighing 779 grams was also fed on October 31, 1907, with a similar amount of barium. This dose was repeated six times during an interval of eight days. At the end of that time the animal still retained its normal weight. On November 14, 1907, it weighed 709 grams, having lost 70 grams. Thus after daily doses of 0.1 gram of crystallized barium acetate no symptoms appeared until the fifth day, when death resulted. After the similar administration of 50 milligrams severe symptoms developed on the same day, but the animal recovered. After the administration of 25 milligrams on three successive days the animal died. In other cases of feeding 25 milligrams for several successive days, some lost weight and died; others merely lost in weight, but recovered.

Bary fed a rabbit weighing 0.9 kilogram a solution of 30 milligrams of barium chlorid on one day, on the second day 90 milligrams, and on the third day 30 milligrams. The only symptom noted was diarrhea. The animal died on the fifth day. In other words, after feeding small doses of barium salts for several days acute symptoms suddenly set in, showing a cumulative action. This cumulative action has been noted on man.[a]

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[a] Bary, A. Beitr. z. Baryumwirkung. Dissert., Dorpat, 1888, p. 100.

Onsum[a] fed a medium-sized rabbit daily with small doses of barium carbonate, beginning with 20 milligrams. When the total amount reached 0.19 grams the rabbit died. The animal before death showed paralysis, respiratory disturbances, and fall in temperature. The sensibility of the cornea diminished, but the pupils responded to light. The stomach walls showed ecchymoses and the blood vessels of the brain, the spinal cord, and the abdominal vessels were dilated. Emboli in the pulmonary arteries were also noted.

In a rabbit the application of 0.66 gram of barium chlorid to a wound was followed in twenty minutes by convulsions, paralysis, and finally coma and death.[b]

Of barium nitrate 0.66 gram mixed with sugar and fed to a rabbit caused death in less than one hour, and 0.33 gram induced death in another rabbit in twenty-seven hours.[c]

Six grains (0.4 gram) of barium iodid fed in solution to a rabbit caused death the following day. On this day there were tremors of the neck and shoulders with convulsive movements of the limbs. There was also grinding of the teeth. "The mucous membrane of the stomach was rose-red at the cardia, and softened." Membranes of the cord and brain also were congested.[d]

For rabbits weighing 1,500 to 2,000 grams the lethal dose of barium chlorid on subcutaneous use is stated to be 0.05 to 0.06 grams.[e]

A rabbit weighing 1,106 grams was fed with a solution containing 50 milligrams of crystallized barium acetate c. p. and 50 milligrams of zirconium chlorid (pure). In fifty-seven minutes the animal showed difficulty in moving the fore legs, developing marked paralysis of the same about five hours later, and died the following morning—that is, twenty-two hours after feeding. The heart was found dilated, kidneys congested, stomach walls pink and covered in places with mucus and partly digested blood, and cerebral dural vessels dilated, but no clots were seen; bladder full.

Mixtures of 0.5 gram of calcium acetate and 50 milligrams of barium acetate failed to kill. Mixtures of titanium and barium were not tried, as no titanium salt soluble in water and of neutral reaction was accessible.

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[a] Onsum, J. Ueber d. toxisch. Wirkung. der Baryt- und Oxalsäureverbindungen. Arch. f. Path. Anat., vol. 28, p. 234. 1863.

[b] Brodie, B. C. Further Experiments and Observations on the Action of Poisons on the Animal System. Philos. Trans., vol. 102, p. 218. 1812.

[c] Tidy, C. M. On Poisoning by Nitrate of Baryta. Med. Press and Circ., vol. 6, p. 448. 1868.

[d] Glover, R. M. On the Physiological and Medicinal Properties of Bromine and Its Compounds. Edinb. Med. & Surg. Journ., vol. 58, p. 341. 1842.

[e] Kissner, G. Ueber Baryum Vergiftungen u. deren Einfluss auf d. Glykogengehalt der Leber. Scholten, 1896, p. 11.

Mittelstaedt called attention to the fact that pregnant rabbits were more easily affected by the barium administration than nonpregnant ones, and noted abortion in one case.[a]

One gram of the barium carbonate killed a dog in eight hours. A second dog died in fifteen hours. Both of these animals vomited so that a portion of this must have been lost.[b] Barium carbonate was formerly employed as a rat poison.[c]

Of barium chlorid 0.6 gram, fed in aqueous solution, caused death in a dog in forty-eight minutes if vomiting was prevented.[d]

In Tidy's hands 2 grams of the barium nitrate caused death in a small terrier in three and three-fourth hours. This dog had slight convulsions, was almost unable to stand, and had vomiting and purging. The reflexes were diminished. A small dog recovered only completely in five days after being fed 0.66 gram, while a large dog after being fed 1.3 grams only recovered after two days.

In cats 0.8 gram of barium carbonate when introduced into a wound caused on the third day languor, slow respiration, feeble pulse, twitching of hind legs, dilated pupils, and death.[e]

BARIUM POISONING IN MAN.

The high toxicity of barium was called attention to by early observers, but it was attributed by some to admixed arsenic. The reports of feeding experiments with barium on animals have varied markedly, but now care is being advised in the use of barium salts.[f]

Barium was introduced into medicine in the treatment of scrofula, but has fallen into disuse, and only recently attention has been called to it on account of its action on the circulatory system. Filippi.[g]

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[a] Mittelstaedt, F. Ueber chronische Bariumvergiftung. Dissert., Greifswald, 1895, p. 19.

[b] Pelletier, D. Observations sur la Strontiane. Annal. de Chimie, vol. 21, p. 119. 1797.

[c] Christison, R. Treatise on Poisons. Edinburgh, 1845, p. 579.—Crampe, Bewährte Mittel gegen Feldmäuse. Deutsch. Landw. Presse, vol. 5, p. 530. 1878.—Felletar, E. Fälle von Intox. mit kohlensäur. Baryum. Pest. Med.-Chir. Presse, vol. 28, p. 1072. 1892.

[d] Husemann, T. Ein Beitrag z. Kennt. d. Barytvergiftungen. Zeits. f. pract. Heilk., vol. 3, p. 235. 1866. In this article Husemann has collected many cases of poisoning by barium in animals.

[e] Christison, R. Treatise on Poisons. Edinburgh, 1845, p. 579.

[f] According to v. Jaksch, " Sie ist bei der grossen Toxicität der Substanz immer ernst zu stellen." Vergiftungen, 1897, p. 79.

NOTE.—A thorough pharmacological study of some barium salt is much needed, and it is hoped that the writer will be able to complete this work.

[g] Filippi, E. Modificaz. del Ricambio Organice per Azione del Cloruro di Bario. La Sperimentale, vol. 60, p. 610. 1906; Sull' Azione Cardiaca del Cloruro di Bario. Archivio di Farmacol. Speriment., vol. 5, p. 122. 1906.

however, says, "The effects on the heart and on the pressure are already the first indication of poisoning." This metal has also been used in the treatment of chronic diseases of the spinal cord, as multiple sclerosis and paralysis agitans.[a]

After the administration to a woman of $\frac{1}{12}$ grain (0.005 gram) of barium chlorid three to five times a day for a few days, a total of $2\frac{1}{4}$ grains (0.135 gram), the patient developed rapid respiration, tenderness over the epigastrium, nausea, constipation, cramps in the limbs, loss of appetite, weakness, great emaciation, dysuria, some deafness with tinnitus, difficulty in speaking and thinking, with vertigo.[b] In this case the eyes were glassy, the vision indistinct, and the cheeks flushed. Kohl after the use of small doses of the same noted salivation, swelling of the gums, and falling out of the teeth, with a mercurial odor to the breath. Christison[c] states: "I have known violent vomiting, gripes, and diarrhea produced in like manner by a quantity not exceeding the usual medicinal doses." According to Kennedy few persons are able to bear $\frac{1}{8}$ grain (0.0075 gram) of barium chlorid.[d]

In Carpenter's case after three doses of 1.6 grains (0.070 gram) of barium chlorid the patient developed almost lethal symptoms.[e] Carpenter calls attention to the drowsiness which developed in this patient after the administration of barium, a fact which had already been noted by Christison.[f]

A cartarrhal affection of various mucous membranes and a swelling of various glands have been noted, especially of the lymph and salivary glands, and in the male the testes have at times swollen.[g] The inflammation of the glands may pass on to suppuration. The skin becomes dry and shows a tendency to crack. Febrile attacks are reported after the repeated use of small doses of barium.

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[a] Schulz, H. Vorles. ü. Wirkung. u. Anwendung d. unorganisch. Arzneistoffe. Leipzig, 1907, p. 234.—Hare, H. A. Use of Barium Chloride in Heart Disease. Med. News, vol. 54, p. 183. 1889.

[b] Ferguson, J. C. Symptoms of Poisoning from Muriate of Barytes. Dublin Quart. Journ. Med. Sci., vol. 1, p. 271. 1846.

[c] Christison, R., l. c., p. 580.

[d] Kennedy, H. Dose of the Muriate of Barytes. Lancet, vol. 2, p. 28. 1873.

[e] Carpenter, J. S. Barium Chloride from a Clinical Standpoint. Med. News, vol. 59, p. 93. 1891.

[f] Christison, R., l. c., 1845, p. 578.

[g] Schulz, H. Vorles. ü. Wirkung. u. Anwendung d. unorganisch. Arzneistoffe. Leipzig, 1907, p. 233.—Schwilgué, C. J. A. Traité de Mat. Méd., 3 ed., vol. 1, p. 441. 1818.

NOTE.—According to the files of the Office of Poisonous-Plant Investigations, E. D. Smith reported in the Orange Judd Farmer, 1897, that locoed animals showed a swelling of various glands. As yet the writer has been unable to verify this reference.

Scheibler[a] has called attention to the possibility of producing *chronic* barium poisoning in man from the use of barium in the manufacture of food products.

Acute cases of poisoning in man from four or more grams of barium carbonate or chlorid or nitrate have been reported more or less frequently.[b] In the acute case of poisoning in man reported by Tiraboschi and Taito, no macroscopic changes were noted in the stomach mucosa.[c] Lopes[d] has reported one case of acute poisoning in man from less than 1 gram of barium chlorid. In this case paralysis of the limbs was a marked feature. Stern[e] cites Perondi and Lisfranc to the effect that "remarkably large doses of barium chlorid can be borne without injury by gradually increasing the doses (dissolved in much water)." Lisfranc[f] has suggested that the sensitiveness to poisoning by barium salts is greater in certain climates than in others.

No data are as yet available as to the influence of altitude and partial starvation on the toxicity of barium salts. As is well known, almost all recorded cases of locoed animals have occurred at a high altitude.

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[a] Scheibler, C. Ueber d. Verwendung giftiger Stoffe, besonders d. Barytverbindungen bei d. Zuckerfabrication. Chem. Zeit., vol. 11, p. 1463. 1887.

[b] Schmidt's Jahrbücher, vol. 192, p. 131. 1881.—Walsh, J. Report of a Case of Poisoning by Chloride of Barium. Lancet, vol. 1, p. 211. 1859.—Walch. Seltener Fall einer tödlich. Vergiftung d. Baryta muriatica. Zeits. f. Staatsarznk., vol. 30, p. 1. 1835.—Carpenter, J. S. Barium Chloride from a Clinical Standpoint. Med. News, vol. 59, p. 93. 1891.—Eschricht. Dødeligt forløbende Forgiftning med salpetersurt Baryt. Ugeskrift for Laeger, vol. 4, p. 241. 1881.—Ogier and Socquet. Empoisonnement par le Chlorure de Baryum. Annal. d'Hyg. Publ., 3 s., vol. 25, p. 447. 1891.—Chevallier, A. Note sur un Cas d'Empoisonnement Déterminé par l'Acétate de Baryte. Annal. d'Hyg. Publ., 2 s., vol. 39, p. 395. 1873.—Courtin, Cas d'Empoisonnement par du Chlorure de Baryum. Rev. d'Hyg., vol. 4, p. 653. 1882.—Poisoning by a Baryta Compound. Pharm. Journ., 3 s., vol. 2, p. 1021. 1872.—Reichardt, E. Vergiftungsfall mit kohlensäurem Baryt. Arch. d. Pharm., 3 s., vol. 4, p. 426. 1874.—Lagarde, P. Acétate de Baryte livré sous le Nom de Sulfovinate de Soude. Union Méd., 3 s., vol. 14, p. 537. 1872.—Baum. Zwei Fälle von fahrlässiger Tödtung durch saltpetersäures Baryt. Zeits. f. Medizinalbeamte, vol. 9, p. 759. 1896.—Funaro, A. Sul Veneficio per Sali di Bario. L'Orosi, vol. 12, p. 397. 1894.

[c] Tiraboschi, A., and Taito, F. Avvelenamento da Bario. Il Risveglio Medico d'Abruzzo e Molise, vol. 1, p. 171. 1906.

NOTE.—A criticism of this case is to be found in Bellisari, G., Su Di un Presunto Avvelenamento da Bario. Il Risveglio Medico d'Abbruzzo e Molise, vol. 2, p. 15. 1907.

[d] Lopes, A. Caso Curioso de Envenenamento Pelo Chloret de Bario. Medicina Contempt., Lisbon, vol. 4, p. 109. 1886.

[e] Stern, E. Vergiftung mit Chlorbarium. Zeits. f. Medizinalbeamte, vol. 9, p. 383. 1896.

NOTE.—The writer has always theoretically questioned the danger of poisoning by loco weeds in well-fed and well-watered animals. Compare Stalker, M., The "Loco" Plant and Its Effect on Animals. Bur. Animal Industry, 3d Ann. Report (1886), p. 271. 1887.

[f] Lisfranc. Leçon sur l'Emploi du Muriate de Baryte contre les Tumeurs Blanches. Gaz. Méd. de Paris, 2 s., vol. 4, p. 215. 1836.

It must also be remembered that the addition of one salt to the solution of another may greatly increase the toxicity of the first one. Thus, the addition of a few milligrams of barium chlorid to a solution of a sulphocyanate renders the latter much more poisonous.[a] This may be due to the fact that the salts are more completely ionized.

PATHOLOGICAL LESIONS IN EXPERIMENTAL BARIUM POISONING.

The post-mortem examinations in cases of acute experimental barium poisoning, according to Schedel,[b] show punctiform or large hemorrhagic effusion in the fundus ventriculi[c] and in the large and small intestines, contraction of the bladder, and hemorrhage into the walls of the bladder and uterus. The heart is usually found relaxed or the left ventricle contracted in systole, while the right is relaxed. Only once were ecchymoses under the endocardium seen. The liver and kidneys showed nothing special. The urine was free from albumen and sugar. In a few cases the lungs showed some infiltration with blood. In chronic cases, according to our own investigations in rabbits, there are no characteristic macroscopic lesions, a result which agrees with Mittelstaedt's report.[d] Nothnagel and Rossbach[e] claim that in chronic poisoning by barium the peripheral nerves are altered. The same negative results have also been reported in chronic poisoning in higher animals. Reynolds[f] noted a layer like a blood clot under the cerebellum in a horse fed with barium chlorid. Fuchs[g] has called attention to the fact that the flesh of cattle poisoned with barium chlorid was harmless, perhaps owing to a conversion into an insoluble salt, a fact which may be considered in the use of locoed animals for food.

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[a] Pauli, W., and Fröhlich, A. Pharmakodynam. Studien. Sitz. Kaiserl. Acad. d. Wissens. z. Wien, vol. 115, III, pt. 6, p. 445. 1906.

[b] Schedel, H. Beitr. z. Kennt. d. Wirkung des Chlorbariums. 1903, p. 13.

[c] After subcutaneous injection of barium chlorid, Lewin, by means of the spectroscope, has found barium in the stomach walls. Lewin, L. Schicksal körperfremder chem. Stoffe im Menschen u. besonders ihre Ausscheidung. Deutsch. Med. Woch., vol. 32, p. 173. 1906.

[d] Mittelstaedt, F. Ueber chronische Bariumvergiftung. Dissert., Greifswald, 1895, p. 29.

[e] Nothnagel, H., and Rossbach, M. J. Handb. d. Arzneimittel, p. 81. 1904.

[f] Reynolds, M. H. A Study of Certain Cathartics. Minn. Agric. Exper. Sta., 15th Ann. Rept. 1907.

[g] Fuchs, C. J. Vergiftungsfälle durch salzsäuren Baryt beim Rindvieh. Thierärztl. Mittheil., vol. 5, p. 159. 1870. Fuchs suggests that further investigations on this point are desirable. The literature of this class of experiments is very scanty. See Fröhner and Knudsen, Einige Versuche über d. Geniessbarkeit d. Fleisches vergift. Thiere. Monats. f. Prakt. Thierheilk., vol. 1, p. 529. 1890.

TOXICITY OF VARIOUS AQUEOUS EXTRACTS OF LOCO PLANTS.

On October 21, 1907, a rabbit weighing 1,531 grams was fed with an extract of 95 grams of dried *Aragallus lamberti* (Hugo, Colo., 1907), with an ash content of 12.44 per cent, with a barium content estimated as 2.6 milligrams of $BaSO_4$ in 1 gram of ash. On the following day it weighed 1,517 grams, and the same dose was again administered. On October 23 the weight was 1,488 grams, and the dose was repeated. On the next day the weight was the same and the dose was repeated. On October 26 the weight was 1,446 grams, and again the same extract was given. On October 30 the animal weighed 1,502.5 grams; on October 31, 1,531 grams. The animal received a total extract of 475 grams of the dried plant without serious injury. This result was apparently contradictory to the earlier work.

On October 21, 1907, a rabbit weighing 1,743 grams was fed with an extract of 47.5 grams of the same dried plant. On the next day its weight was 1,729 grams, and the same amount of the extract was fed. On October 23 the weight remained the same, and the dose was repeated. On October 24 the weight was 1,658 grams, and the same amount of extract was fed. On October 26 the animal weighed 1,630 grams, when it was again fed with the same amount of extract. On October 28 the animal weighed 1,573.5 grams, but two days later the weight had risen to 1,644 grams. An extract of 237.5 grams had been administered. Here again the results appeared contradictory.

On October 21, 1907, a rabbit weighing 1,517 grams was fed with an extract of 77.5 grams. On the next day it weighed 1,545 grams, and the dose was repeated. On October 23 the animal weighed 1,531 grams, and the same amount of extract was given. On the following day it weighed 1,488 grams, and the dose was repeated. On October 26 it weighed 1,474 grams, and again the dose was repeated. On October 30 the weight had risen to 1,545 grams, and on October 31 it was 1,559 grams. This animal received in all an extract of 387.5 grams of the dried plant. An aqueous extract of 200 grams of the same in one dose also failed to produce the acute symptoms.

These feeding experiments show little of the characteristic action seen in the earlier experiments made with aqueous extracts either of the dry plant or of the fresh plant preserved with chloroform. In other words, the aqueous extract of the dried plant was only slightly poisonous, yet the plant from which the extract was made contained barium.

Of this same dried loco 200 grams were then extracted with water and digested with pepsin and finally with pancreatin in the thermostat (37.5° C.). The extract was concentrated and fed to a rabbit weighing 1,616 grams. After five hours and ten minutes the animal appeared weak in the fore legs and unable to support himself, and he died during the night. The intestines the following morning were found full of gas, the stomach red, the lungs seemed normal, and the heart was relaxed.

A rabbit weighing 1,545 grams was fed on November 15, 1907, with a preparation made in a similar manner, save that the plant was not extracted with water before digestion. On the next day it weighed 1,517 grams and on November 19, 1,361 grams. The following day the weight was 1,318 grams; on November 21, 1,233 grams, and on the next day 1,162 grams. The animal died during the night, and the autopsy was made the following morning.

The animal was greatly emaciated and the subcutaneous fat had almost all disappeared. The mesenteric vessels were dilated, but the intestines were not dilated. The peritoneal cavity was normal. The kidneys were perhaps a little injected, and measured 3 cm. in length. The lungs were normal. The left ventricle was contracted and the rest of the heart relaxed. The liver was normal and the spleen apparently normal. The stomach walls were dark, owing to decomposition. No ulcers were seen. The suprarenals were perhaps a little enlarged. The examination of the brain was negative, and no clots were found.

A similar digestion from 200 grams of the same dried plant was then ashed and the ash treated with acetic acid and freed from acid by evaporation on the bath. The ash which was insoluble in water was ground up into a fine paste and the whole was fed to a rabbit weighing 992 grams. This animal died in forty minutes, showing the characteristic symptoms seen in acute cases already described. In the autopsy the lungs and other organs seemed perfectly normal macroscopically. The stomach walls, however, were reddened and ecchymotic, and the mesenteric vessels were dilated.

On January 8, 1908, a similar digestion of the same batch was treated with a few drops of sulphuric acid to remove the barium, and the filtrate was then treated with lead carbonate to remove the sulphuric acid. After careful filtering, H_2S was passed into the solution and after concentration was fed in one dose on January 9, 1908, to a rabbit. The following morning the rabbit had gained in weight. On January 14 this animal weighed 30 grams more than its initial weight.

The residue of this plant after such a digestion, examined by the Hillebrand method, showed no weighable amount of barium, so that it can be seen that barium in relatively large amount was found in the plant itself, but not after the digestion. It must therefore have been the aqueous digestion which produced the characteristic symptoms. The examination of this fluid for barium might, however, be misleading, as the large amount of proteids would unquestionably interfere with the determination of this amount of barium, unprotected by other salts and silica, so that this side of the investigation was not pursued. Control feedings with an emulsion of one-half gram each of pepsin and pancreatin proved inactive.

Of the same *Aragallus lamberti* 200 grams were similarly digested and the barium was removed with a few drops of H_2SO_4, the sulphuric acid by $PbCO_3$ and a little lead acetate, and the lead by H_2S. Such an extract it was shown in the previous experiment would not kill. However, to this extract was added 100 milligrams of crystallized barium acetate in a solution and a precipitate formed. Nevertheless, the liquid and the precipitate were fed on February 1, 1908, to a rabbit weighing 1,304 grams. On February 3 the animal weighed 1,233 grams; on February 4, 1,176 grams; February 5, 1,120 grams; February 6, 1,006 grams; February 7, 1,219 grams; February 8, 1,219 grams; February 10, 1,304 grams.

As a control for this animal, to make sure that the loss in weight was not due to the acetic acid set free by the treatment with H_2S, a similar aqueous extract of the same lot of *Aragallus lamberti* was precipitated with very much more lead acetate than in the preceding cases and also with lead subacetate and then H_2S. After evaporating to dryness this was fed on February 8, 1908, to a rabbit weighing 1,035 grams. On February 11 it weighed 1,021 grams; on February 13, 1,091 grams, and on February 15, 1,120 grams, showing a gain in weight.

Of the dried *Astragalus missouriensis* (Hugo, Colo., June, 1907) 400 grams with an ash content of 21.8 per cent and which was known to contain barium (3 mg. $BaSO_4$ in each 2 grams of the ash) were extracted with water and fed in four doses corresponding to 100 grams each in a period of four days. On November 18, 1907, the first day of feeding, this rabbit weighed 1,856.7 grams. Fifteen days later it weighed 1,984.3 grams.

One hundred grams of this dried plant after extraction with water were found to leave about 51.1 grams[a] of the plant undissolved. This when ashed yielded 8.2 grams of ash. Two grams of this ash yielded 5 milligrams of $BaSO_4$. In other words, the aqueous extract of the plant was inactive and the barium was found practically unextracted in the residue of the plant.

Evidently the barium in these dried plants had been converted into an insoluble form by drying or by some peculiarity of its metabolism, and was not extracted by water, but could be extracted by digesting the plants with the combined digestive ferments, pepsin and pancreatin.

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[a] Some was lost, being attached to the cloth used in squeezing the extract.

Of the same dried *Astragalus missouriensis* 200 grams were extracted with water and the extract treated with lead carbonate to remove any possible free sulphates and after filtering this was treated with H_2S to remove the lead. As the preceding experiment showed that the aqueous extract of this dried plant was harmless without barium, the writer decided to add barium artificially, and 100 milligrams of barium phosphate,[a] crystallized, was added to the liquid and the whole fed to a rabbit weighing 2,423.9 grams. The following morning the rabbit was found dead. The autopsy was made by Dr. H. J. Washburn, of the Bureau of Animal Industry. He found that the suprarenals were enlarged and congested, and there were small areas of hepatization at the apex of each lung. There were also acute corrosion areas on the greater curvature of the stomach and over the upper portion of the duodenum.

Of the *Astragalus missouriensis* used in the preceding experiments, 200 grams were extracted thoroughly with water, and the extract corresponding to 100 grams, together with 80 milligrams of barium phosphate pure, was fed on March 12, 1908, to a rabbit weighing 1,261.5 grams. During this day the animal walked at times with an uncertain gait and the following morning it weighed 1,233 grams. It was then fed the rest of the solution, that is, the extract of the remaining 100 grams of the plant, but without any barium. The animal soon developed convulsions and died in a little over twenty-four hours after the original feeding. The autopsy, which was made by Dr. J. R. Mohler, of the Bureau of Animal Industry, showed that the mucous membrane of the stomach was markedly hemorrhagic and in areas gelatinous infiltration was very marked. In one portion of this hemorrhagic area there was distinct erosion. The large intestines were full of gas, the lungs were normal, the heart was relaxed, and the lungs collapsed. The blood vessels of the kidneys were markedly engorged.

Of the dried *Astragalus nitidus* (Woodland Park, Colo., October, 1907) which was reported by the Bureau of Chemistry as containing no barium, 200 grams were extracted with water and fed in 100-gram doses for two successive days. The animal increased steadily in weight and fifteen days after the first feeding had gained 99.2 grams. This amount of the plant was also extracted with water and the residue was then digested with pepsin and pancreatin in the thermostat, as in the previous case, and fed in two doses corresponding to 100 grams each. This animal increased in weight, gaining 60 grams in six days and 165 grams in addition after a further fifteen days.

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[a] This barium phosphate was determined by the Bureau of Chemistry to be $BaHPO_4$ and to contain traces of iron, sodium, and potassium, but it was free from arsenic.

An *Astragalus mollissimus* (Kit Carson County, Colo., December, 1906), which was also reported by the Bureau of Chemistry as containing no barium, was extracted with water, and a dose corresponding to an extract of 200 grams of the dried plant was fed in one dose without any serious result. The same amount of the dried plant was also similarly digested with pepsin and pancreatin and fed in two doses, but without the production of any symptoms, the rabbit gaining 60 grams in four days.

Of the *Aragallus lamberti* (Hugo, Colo., June, 1907), with an ash content of 12.44 per cent, 250 grams were ashed and the ash treated with acetic acid and, after evaporating off the acetic acid, was extracted with water and the ash digested with pepsin and pancreatin. The aqueous extract and the digestion products of the ash were then fed after concentration, but without any serious effects to the animal, indicating that in this plant the barium is in a form insoluble in water and in the ashing is further changed so that it can not now be made soluble by digestion—an opposite result to the experiment in which the barium was first rendered soluble by digestion and the digestion products ashed, suggesting a possibility that plants might be found in which the barium is not extracted by digestion, at present a hypothesis.

Of dried *Astragalus decumbens* (Ephraim, Utah, 1907), which was reported by the Bureau of Chemistry to contain no barium, 200 grams also failed to produce symptoms in rabbits by our test.

A solution containing 50 milligrams of barium acetate (crystallized) was mixed with an aqueous extract of 200 grams of the dried *Aragallus lamberti* which had proved inactive pharmacologically, but a precipitate formed ($BaSO_4$?) and the extract still remained inactive, suggesting that the question of toxicity depended not only upon the presence of barium, but also whether other agents, such as sulphates, etc., might not be present in sufficient amount to render the barium insoluble; that is, pharmacologically inactive.

This *Aragallus lamberti* yielded an ash content of 37.3 per cent, and the SO_3 group was estimated at 0.27 per cent of the ash, while a corresponding lot which was obtained two years later from the same area yielded an ash content of 12.44 per cent and a SO_3 content of 0.24 per cent of the ash.

It may be urged that the full lethal dose of the barium was not always found in the plant, yet it must be remembered that the toxic action was the resultant of the action of the total constituents and that if the barium was removed the extract was practically harmless.

In looking back over the work the most suitable preparation for producing the characteristic symptoms in rabbits seems to be the freshly ground-up plant mixed with water and preserved in chloroform, for while the dried plant might contain barium, yet the aqueous extract was often inactive, suggesting, perhaps, the presence of something in the fresh plant which aided the solution of the barium, thus accounting for the variations in toxicity of aqueous extracts made from plants dried under varying conditions. The nature of the compound in which barium exists in the plant is as yet unknown and has not been investigated. *It is important to remember that not only must barium be found in the plant to prove poisonous, but it must be in such a form that it can be extracted in the gastro-intestinal canal.*

The amount of barium found in various species of loco plants will no doubt vary, and perhaps the pharmacological test on rabbits as the writer has used it may have to be modified for such plants, so that at present the wisest plan to test these plants is to determine their barium content and also make the physiological test, as has been proposed, and if the barium content runs low, say below 0.11 per cent of the ash, in plants yielding from 12 to 18 per cent of ash, then to increase the number of feedings on the rabbit. No doubt on ranges where a large number of loco plants are eaten, with little other food, plants with a very low barium content may be poisonous, but if large amounts of other food are fed the writer would expect few, if any, serious results.

As the writer's work has been confined to the laboratory side of the loco-weed investigations no feeding experiments with barium salts have been made by him on large animals. Such experiments should, of course, be made under range conditions; that is, where the water and food supply is deficient.

THEORETICAL ANTIDOTE FOR LOCO-WEED POISONING.

The fact that treatment of the loco-weed extract with a few drops of sulphuric acid, which will remove the barium, renders these extracts harmless, and even apparently nutritious, would suggest the theoretical antidotal treatment to be with sulphates, in the form, perhaps, of epsom salts, but perhaps alkaline bicarbonates may be present in the stomach, either due to lessened acidity of the stomach or from drinking alkaline waters, in which case the precipitation of the barium by sulphates would presumably be interfered with, and thus the treatment be rendered ineffectual.[a] It is interesting to note that most of the remedies proposed for the successful treatment of locoed animals contain sulphates.[b]

In Storer's experiments on feeding rats with barium carbonate it was found that the barium carbonate would kill them, but if calcium carbonate was mixed with the barium the rats survived, suggesting an antidotal action. This apparent antagonism deserves further study and may lead to practical results.[a] A somewhat similar antagonism for at least a part of the action of barium has been claimed to exist between barium and potassium.[b] However, extracts of ashed plants, treated with acetic acid, which contained calcium and potassium, caused death in the experiments of the writer, but no work has yet been done by him as to the antidotal action of calcium carbonate on barium. Then, too, as Lüdeking[c] pointed out, large quantities of calcium chlorid may interfere with the precipitation of barium as a sulphate. It is well known that the presence of various salts influences the solubility of barium sulphate in water,[d] and the fact that barium has been found in solution in the urine in the presence of sulphates shows that the precipitation of barium as a sulphate in the body is not so simple as in test-tube experiments.[e] Again, in very dilute solutions, such as must necessarily occur at any one time in the stomach, the precipitate with sulphates only slowly forms and the barium may be absorbed before the insoluble compound can be formed.[f] Evidently an important point to be considered in the antidotal treatment of locoed animals with sulphates is the possibility of inducing a gastritis, with its attendant loss of weight. It therefore seems apparent that the proper treatment at present is preventive—that is, removal from the plants.

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[a] Mendel, L. B., and Sicher, D. F., l. c., p. 148.

[b] Mayo, N. S. Some Observations upon Loco. Kans. State Agric. Coll. Bul. 35, p. 119. 1893.

Lewin[g] has suggested the possibility of acquiring some immunity to barium, but our experiments point against the production of any practical immunity.

ACTION OF BARIUM ON DOMESTIC AND FARM ANIMALS.

Barium in the form of barium chlorid has been recently introduced into veterinary therapeutics by Dieckerhoff[h] in the treatment of constipation, but Winslow[a] says that "the doses required to produce catharsis in the horse are almost toxic," and he advises against the intravenous use of this remedy.

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[a] Storer, F. H. Experiments on Feeding Mice with Painter's Putty and with Other Mixtures of Pigments and Oils. Bul. of Bussey Institute, vol. 2, p. 274. 1884.

[b] Brunton, T. L., and Cash, J. T. Contribution to Our Knowledge of the Connection between Chemical Constitution, Physiological Action, and Antagonism. Philos. Trans. Royal Soc. London, I, vol. 175, p. 229. 1884.

[c] Lüdeking, C. Analyse d. Barytgruppe. Zeits. f. Anal. Chem., vol. 29, p. 556. 1890.

[d] Fraps, G. S. Solubility of Barium Sulphate in Ferric Chloride, Aluminum Chloride, and Magnesium Chloride. Amer. Chem. Journ., vol. 27, p. 288. 1902.

[e] Santi has paid special attention to the solubility of barium in the body.

[f] Fresenius, C. G. Man. of Qualitat. Chem. Anal. Tr. by H. L. Wells, 1904, p. 148.

[g] Lewin, L. Nebenwirkungen d. Arzneimittel, 2 ed., p. 439. 1893.

[h] Dieckerhoff. Ueber d. Wirkung d. Chlorbaryum bei Pferden, Rindern und Schafen. Berliner Thierärztl. Woch., p. 265; see also pp. 313 and 337, 1895; Abstract in Vet. Mag., vol. 2, p. 360. 1895.

Fröhner[b] has carefully summarized the literature on the use of barium chlorid in veterinary work, and reports that its use in the Zürich clinic has recently been so unsatisfactory that it is now seldom employed and that in the last ten years the preponderance of reports in the literature are unfavorable to the use of this agent in colic.

After the administration per os, much of the barium must be carried off in the diarrheal stools. A number of deaths in horses have been attributed to the use of this agent. No doubt the presence of sulphates, etc., derived from the food would render the barium insoluble in the gastro-intestinal tract, and this would explain the lack of poisonous action in certain of the cases in which large doses of barium proved harmless.

Husard and Biron administered daily doses of 8 grams of barium chlorid to one horse, and the same amount of barium carbonate to a second horse, for several days. A fortnight later the first horse unexpectedly died, and the second a few days later. The post-mortem examination was negative.[c] A third horse fed with barium carbonate also died suddenly. Recently barium occurring in brine has given rise to acute poisoning in stock.[d]

In a case reported by Stietenroth[e] the horse died after the injection of 0.5 gram of barium chlorid into the jugular vein. A number of sudden deaths in horses after the intravenous injection of 0.7 gram and over of barium chlorid have been collected by Fröhner.[f] The lethal dose by mouth for acute poisoning with barium chlorid in horses lies between 8 to 12 grams, while cattle require much larger doses (40 grams)[g] to induce death.

Dieckerhoff advises against the use of barium chlorid in the treatment of constipation in sheep.

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[a] Winslow, K. Vet. Materia Medica and Therapeutics, p. 152. 1901.

[b] Fröhner, E. Lehrb. d. Arzneimittellehre, p. 399. 1906. Fröhner gives a detailed account of these cases.

Original note in Ehrhardt, J. Erfahrungen ü. ältere u. neue Arzneimittel. Schweizer Archiv. f. Thierheilk., vol. 41, p. 44. 1899.

[c] Pelletier. Observations on Strontian. Journ. Nat. Philos., vol. 1, p. 529. 1797; original in Annales de Chimie, vol. 21, p. 127. 1797.

[d] Howard, C. D. Occurrence of Barium in the Ohio Valley Brines and Its Relation to Stock Poisoning. W. Va. Univ. Agric. Exper. Sta. Bul. 103. 1906.

[e] Stietenroth. Ueber Chlorbarium bei der Kolik der Pferde. Berliner Thierärztl. Woch., p. 16. 1899.

[f] Fröhner, E. Lehrb. d. Toxikol., 2 ed., p. 116. 1901.

[g] Fröhner, E., l. c., p. 116.

See similar reports in Veterinarian, vol. 68, p. 572, 1895, and vol. 69, p. 228, 1896; Zeits. f. Veterinärk., vol. 8, pp. 99 and 211, 1896; Nagler, F., Berliner Thierärztl. Woch., p. 65. 1896.

After a dose of 6 grams of barium chlorid a 2-year-old healthy ram appeared perfectly well, but the following day he was depressed, refused to eat, staggered, and became so weak that he was unable to stand. The muscles of the extremities were paralyzed and the animal died. "The post-mortem examination revealed œdema of the lungs, slight cloudiness of the heart muscles, numerous small hemorrhagic spots on the mucous membrane of the small intestine, and stagnation of the blood in the vessels of the small and large intestines. Similar symptoms and lesions were found in a lamb 4 months old which was given per os 6.0 grams of barium chlorid dissolved in 200 grams of distilled water."[a]

Poisonings with barium carbonate have also been reported in pigs.[b] Domestic animals pastured in the neighborhood of barite deposits soon succumb,[c] and accidental cases of poisoning are reported in cows. Poisoning in dogs has also been reported after the subcutaneous use of this agent.[d] Linossier says that if the barium salts are used for any time the salts are deposited in various organs, largely in the kidneys, brain, and medulla, but especially in the bones.[e]

APPLICATION OF THE RESULTS OF THESE INVESTIGATIONS TO THE RANGE.

It has been calculated that a medium estimate of food for cattle on green fodder is about 60 pounds (30 kilos) a day.[f] Calculating this entirely in terms of *Aragallus lamberti* and allowing 10 per cent of moisture for these plants (Sayre) would make 27 kilos of dry loco eaten by each animal per diem. In the analysis of the writer of one *Aragallus lamberti* from Hugo, Colo., it was found to yield 12.44 per cent of ash, and the barium content corresponded to 2.6 milligrams $BaSO_4$ in each gram of the ash. This would correspond to 10.24 grams of barium acetate $(Ba(C_2H_3O_2)_2 + H_2O)$ or 9.15 grams of barium chlorid $(BaCl_2 + 2H_2O)$ per diem. This amount daily administered would, theoretically, readily produce chronic poisoning owing to the accumulation in the system, as was shown in the case of rabbits.

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[a] Dieckerhoff, W. Vet. Mag., vol. 2, p. 362. 1895.

[b] Kabitz, H. Ueber d. Wirkung einiger Baryumsalze beim Schwein. Deutsch. Thierärztl. Woch., vol. 13, p. 317. 1905.

[c] Parkes. Chem. Essays, vol. 2, p. 213. Quoted by Christison, R., in Treatise on Poisons, Edinburgh, 4 ed., p. 581, 1845.—Fuchs, C. J. Vergiftungsfälle durch salzsäuren Baryt beim Rindvieh. Thierärztl. Mittheil., vol. 5, pp. 133, 154. 1870.

[d] Falk. Zur Vergift. von Hunden mit Chlorbarium. Berliner Thierärztl. Woch., p. 40. 1897.—Schirmer, Chlorbariumvergift. beim Hunde. Berliner Thierärztl. Woch., vol. 23, p. 268. 1897.

[e] Linossier, G. De la Localisation du Baryum dans l'Organisme à la Suite de l'Intoxication Chronique par un Sel de Baryum. Comp. Rend. Hebd. Soc. de Biol., 8 s., vol. 4, p. 123. 1887.

NOTE.—Other cases of poisoning in animals may be found in Marder, Beitrag z. Giftwirkung des Baryum chloratum. Berliner Thierärztl. Woch., vol. 37, p. 436. 1897; Absichtliche Vergift. mit Chlorbarium. Zeits. f. Veterinärk., vol. 9, p. 72. 1897.

[f] Lane, C. B. Soiling Crop Experiments. N. J. Agric. Exper. Sta. Bul. 158, p. 18. 1902.—Woll, F. W. One Hundred American Rations for Dairy Cows. Univ. Wis. Agric. Exper. Sta. Bul. 38, p. 12. 1894.—N. J. State Agric. Exper. Sta., 20th Ann. Rept. (1899), p. 193. 1900.

There is, however, some question as to whether this full theoretical amount of loco plants is eaten on the range, and the estimate has been made that one-sixth of this amount only would be actually taken. It must be remembered, as Stalker pointed out, that locoed animals develop an especial taste for these plants and after a time reject other food, so that while the number of loco plants at first taken may be small, yet later, perhaps, it is greater. A part of this barium, however, may not be taken up by the system, but may pass out undissolved. No actual experiments have yet been made with cattle by feeding small doses of the pure salt.

No doubt more of the pure barium salts will be required to produce symptoms of poisoning in animals than would be necessary in the case of the form of barium found in the plant, as in the loco weed the barium is probably better protected from precipitation than are the barium salts when dissolved in water alone.

CONCLUSIONS.[a]

(1) Conditions analogous to those met with in locoed animals occur in other portions of the world, especially Australia.

(2) The main symptoms described in stock on the range can be reproduced on rabbits by feeding extracts of certain loco plants. Those especially referred to here under the term "loco plants" are *Astragalus mollissimus* and *Aragallus lamberti*.

(3) The production of chronic symptoms in rabbits is a crucial test of the pharmacological activity of these plants.

(4) The inorganic constituents, especially barium, are responsible for this action, at least in the plants collected at Hugo, Colo. Perhaps in other portions of the country other poisonous principles may be found.

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[a] Résumé of the results of the loco-weed investigations carried on by the Bureau of Plant Industry was issued as Bulletin 121, part 3, Bureau of Plant Industry, on January 28, 1908, in the form of papers by C. Dwight Marsh and Albert C. Crawford, respectively, under the titles "Results of Loco-Weed Investigations in the Field" and "Laboratory Work on Loco-Weed Investigations."

(5) A close analogy exists between the clinical symptoms and pathological findings in barium poisoning and those resulting from feeding extracts of certain loco plants. Small doses of barium salts may be administered to rabbits without apparent effect, but suddenly acute symptoms set in analogous to what is reported on the range.

(6) The administration of sulphates, especially epsom salts, to form insoluble barium sulphate would be the chemical antidote which would logically be inferred from the laboratory work, but of necessity this would have to be frequently administered and its value after histological changes in the organs have occurred remains to be settled. But even the treatment of acute cases of barium poisoning in man is not always successful, even when sulphates combined with symptomatic treatment are employed. The conditions under which the sulphates fail to precipitate barium must be considered. At present it seems best to rely on preventive measures rather than on antidotal treatment.

(7) Loco plants grown on certain soils are inactive pharmacologically and contain no barium. In drying certain loco plants the barium apparently is rendered insoluble so that is is not extracted by water, but can usually be extracted by digestion with the digestive ferments.

(8) The barium to be harmful must be in such a form as to be dissolved out by digestion.

(9) In deciding whether plants are poisonous it is desirable not merely to test the aqueous or alcoholic extract, but also the extracts obtained by digesting these plants with the ferments which occur in the gastro-intestinal tract.

(10) It is important that the ash of plants, especially those grown on uncultivated soil, as on our unirrigated plains, be examined for various metals, using methods similar to those by which rocks are now analyzed in the laboratory of the United States Geological Survey.

(11) It is desirable to study various obscure chronic conditions, such as lathyrism, with a view to determine the inorganic constituents of lathyrus and other families of plants.

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U. S. DEPARTMENT OF AGRICULTURE.

BUREAU OF PLANT INDUSTRY—BULLETIN NO. 130.

B. T. GALLOWAY, *Chief of Bureau.*

DRY-LAND AGRICULTURE.

PAPERS READ AT THE SECOND ANNUAL MEETING OF THE COOPERATIVE EXPERIMENT ASSOCIATION OF THE GREAT PLAINS AREA, HELD AT MANHATTAN, KANS., JUNE 26-27, 1907.

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LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Bureau of Plant Industry,
Office of the Chief,
Washington, D. C., June 8, 1908.

Sir: I have the honor to transmit herewith some papers on dry-land agriculture read at the second annual meeting of the Cooperative Experiment Association of the Great Plains Area, and to recommend their publication as a bulletin of the series of this Bureau.

The association mentioned is an organization made up of workers in the Department of Agriculture and in the State agricultural experiment stations who are cooperating in the agricultural development of the Great Plains. This organization has proved of great value in coordinating the various lines of work being conducted in the Great Plains and in bringing the men into closer and more sympathetic association. It is believed that the papers read at its meetings will prove of value to all interested in the agricultural development of this region. The membership of the association is confined entirely to Department and experiment station men, most of whom are either officials or collaborators of the Department of Agriculture.

Respectfully,

B. T. Galloway,
Chief of Bureau.

Hon. James Wilson,
Secretary of Agriculture.

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DRY-LAND AGRICULTURE.

PAPERS READ AT THE SECOND ANNUAL MEETING OF THE COOPERATIVE EXPERIMENT ASSOCIATION OF THE GREAT PLAINS AREA, HELD AT MANHATTAN, KANS., JUNE 26 AND 27, 1907.

INTRODUCTORY STATEMENT.

While establishing the work in dry-land agriculture in the Great Plains area the need was recognized of bringing the widely-scattered station workers in the area together for the purpose of discussing and conferring with each other about the various lines of cooperative work to be carried on at these stations. A meeting was held in Washington, D. C., on November 15, 1905, for the purpose of considering the advisability of organizing an association which would bring into close relationship the officers of the Department of Agriculture and of the experiment stations who were carrying on cooperative work in dry-land agriculture in the Great Plains area.

The meeting was presided over by Dr. B. T. Galloway, Chief of the Bureau of Plant Industry, and there were present either the presidents of the agricultural colleges or the directors of the agricultural experiment stations of the States lying within the area, as well as a number of Department men interested in the work.

An organization was effected and the title of "The Cooperative Experiment Association of the Great Plains Area" was adopted. The purpose of this organization, it was stated, "shall be to encourage and facilitate the coordination, systematization, and unification of all cooperative experimental work to be engaged in by the Bureau of Plant Industry and the experiment stations and substations of the several States included in whole or in part within the Great Plains area."

It was decided that meetings should be held at least twice each year—one of these to be held within the area—at which "papers shall be read, addresses delivered, and discussions carried on bearing directly upon the cooperative work of the Great Plains area." It was agreed that the directors and agriculturists of all States included in whole or in part within the Great Plains area and other members of the experiment stations' staffs engaged in cooperation with the Department of Agriculture and all officers and members of the Bureau of Plant Industry who are interested and actively engaged in cooperative work in this area should be considered eligible for membership. Officers are to be elected annually.

The first annual meeting was held at Lincoln, Nebr., June 21–22, 1906, at which meeting a number of very interesting papers on important problems were read, but, owing to the fact that no arrangements had yet been made for the publication of papers by the association, they were published elsewhere.

The second annual meeting was held at Manhattan, Kans., June 26–27, 1907, with President E. A. Burnett in the chair. After an address of welcome by President E. R. Nicholls, of the Kansas Agricultural College, several papers were read and discussed. All are included in this bulletin, except one by Mr. T. H. Kearney, of the Department of Agriculture, upon "A striking example of dry-land arboriculture," describing the growing of the date palm in the Sahara; a paper by Prof. J. B. Nelson, superintendent of dry-farm work, Montana, upon "Dry farming in Montana;" and a paper by Dr. R. P. Hibbard, of the Department of Agriculture, upon "Soil bacteria."

E. C. CHILCOTT,
Agriculturist in Charge of Dry-Land
Agriculture Investigations.

WASHINGTON, D. C., *May 26, 1908.*

THE DEVELOPMENT OF DRY-LAND FARMING.

By E. A. BURNETT, *Director of the Nebraska Agricultural Experiment Station, Lincoln, Nebr.*

The development of agriculture in the semiarid regions of the Great Plains area is a question of national importance. It involves the settlement of a large area of fertile land, awaiting only the conservation of moisture sufficient to insure the growth of crops or the selection of varieties which can maintain themselves under conditions which are often favorable, but sometimes extremely unfavorable, to crop production. The conservation of moisture in the soil by tillage to make up for the lack of rainfall during the growing period, the selection of early-maturing and of drought-resistant crops, and the practice of crop rotation to maintain fertility and the proper physical conditions of the soil seem to me the great problems which must be worked out in order that crop production may be extended into the region which has hitherto been occupied largely for grazing purposes.

Moisture is the great problem. Much of this area receives sufficient rainfall each year to grow an abundant crop, provided all this water could be trapped where it falls and be used by the crop. The great problem is to trap the water, to absorb the rain as it falls and prevent its running off, to impound the water in the subsoil reservoir and reserve it for the use of the crop when it may be needed for the purpose.

In this region of scant rainfall the distribution of water is particularly uncertain, a large proportion of the precipitation falling as local showers, which may come at opportune times over a small area, but leave many sections of the country—in fact, the greater part—to depend for the success of the crop upon water which has fallen at some earlier date. Unless it is possible through the conservation of moisture in the soil to grow certain grain crops practically without precipitation during a period of their growth, grain production in this region will necessarily be uncertain and hazardous. Not only is the precipitation uncertain in this region, but it often falls greatly in excess of the amount needed for immediate use, in the form of violent local storms which are so clean-cut in their outline that one farm may receive an excess of water while the adjoining land is left dry and thirsting for rain. Grass land where closely pastured loses much of the rainfall by run-off and evaporation. Land which is plowed and cultivated to keep the surface loose furnishes ideal conditions for the absorption of rain and also furnishes the best condition to prevent the escape of the water which has entered the soil.

It is unnecessary for me to discuss the method of conservation of soil moisture before this body. We recognize the fact that soil moisture can be stored by cultivation sufficiently to insure a crop the following year where crop production would be hazardous or impossible without this previous preparation. The extent to which moisture can be stored, the extent and kind of cultivation necessary, and the minimum rainfall under which crop production is possible, I leave for others to discuss. These questions still need more accurate and extensive investigation. Many thousand acres of land which will not grow a crop every year are now being farmed by this method. Where rainfall is nearly sufficient to produce a crop the summer fallow is not needed every alternate year. Possibly only a short period of tillage previous to the sowing of the crop is necessary, but it is essential that an abundance of moisture should be present, especially in the subsoil. We must not be deceived into the idea that it will always rain just at the right time. This is exactly the thing which does not happen. Enough water should be stored in the soil to make the crop sure. If rainfall is abundant you will still produce a crop. I believe the conservation of soil moisture to be the most important question in farming in the semiarid country.

Summer tillage does more than to store moisture. It encourages the accumulation of nitrates in the soil. It puts the land in the proper physical condition for the growth of the crop, so that at the time the crop is planted all the conditions are favorable for its immediate germination and growth.

The problem of preventing the blowing of the soil under this intensive method of cultivation is serious. The high evaporation of moisture from the soil in the western country is due largely to the high velocity of the wind. The cultivation necessary to store moisture and produce the perfect tilth required for the best growth of the crop favors both the blowing and washing of soils. Rolling lands can not long be cultivated under such methods without washing badly, and I know of no alternative but to seed these lands down to grass or keep them for a considerable portion of the time in sod. Fortunately, over most of this region alfalfa can be grown with considerable success—over much of it with very marked success—and, if it is possible to cultivate land in a rotation by which it shall be held in grass for three or four years in a seven or eight year rotation, much of the damage which would otherwise result from excessive washing and blowing can probably be overcome.

The selection of the soil will also help materially in preventing its loss by blowing. We have not yet reached the period when all the land in this western area must be cultivated. In fact, it is probable that only a small percentage of this land should be under plow, and that only gradually should we try to reclaim for the use of the grain farmer the country which has proven successful as cattle range. The hard, level lands may be used for cultivation, while the rougher and sandier portions of the country can be maintained as range. In this way we shall minimize or overcome the losses from blowing and soil washing.

The planting of trees, especially for wind-breaks, should not go without mention in this connection, as nothing will so permanently check the force of the wind as the growth of timber; but the production of forests requires a generation. The influence of wind-breaks on the velocity of the wind is but local, affecting the land for only a short distance away from the wind-break. Agriculture on a large scale must depend upon some other method of preventing the loss of soil than by foresting this great area of land which we seek to put under the plow.

The selection of varieties of crops suited to the dry region is also of prime importance in connection with this question. Certain principles should be worked out which apply to the general crops to be grown in this region. In this connection two important factors should be considered: (1) The selection of crops which can be grown and matured before the period of ordinary summer drought, and (2) the selection of those crops which can withstand a period of drought and continue their growth when sufficient moisture is later available.

In this connection it occurs to me that throughout a large portion of the Great Plains area winter wheat should be looked upon as a standard crop, and an effort should be made to determine the limits under which it may be successfully grown. It is true that the time when drought conditions will prevail can not be determined to a certainty. Winter drought is a common form. While spring rains are generally abundant, they are sometimes lacking until late spring or early summer. On the whole, however, I believe that winter wheat may be grown with little danger of winterkilling or of early spring drought if sufficient attention is given to tillage and the conservation of moisture previous to sowing the crop. Winter wheat possesses a decided advantage over the spring varieties—even over the durum wheats—which have been grown in Nebraska. It ripens considerably earlier and outyields the spring varieties. It is not greatly injured by early spring droughts when sown upon summer-tilled land. Under the conditions prevailing in Nebraska it has been possible to secure a good stand of winter wheat in the fall when lands not under summer tillage were too dry to germinate grain. In this connection it may be interesting to state that light seeding—from one-half bushel to one bushel per acre—has yielded as well as heavier seedings. There seems to be little difference in the thickness of the grain at the ripening time between plats which had received one-half bushel of seed per acre and those which had received one bushel or more. This would indicate that in the ordinary heavy seeding only a portion of the grain ever occupies the ground, and that thick seeding at most does nothing more than prevent the tillering of the grain. It is presupposed in cases where light seeding is followed that the weeds have been killed so that they will not come on and occupy the ground before the grain has developed sufficiently to prevent their growth. The yields of winter wheat at the substation at North Platte in the year 1906 were as follows:

Turkish Red wheat, sown at the rate of 1¼ bushels per acre, yielded 42.13 bushels.

Turkish Red wheat, sown at the rate of 1 bushel per acre, yielded 44 bushels.

Turkish Red wheat, sown at the rate of ½ bushel per acre, yielded 42.3 bushels.

Kharkof wheat, sown at the rate of 1¼ bushels per acre, yielded 45.7 bushels.

The crop of winter wheat for 1907 at the North Platte substation promises to be as good as that harvested the previous year.

The durum wheats are now commonly grown throughout western Nebraska, and with quite satisfactory results. The area is annually extending into regions where wheat has not before been produced as a profitable crop. I am still of the opinion, however, that winter wheat will be more profitable than the durum wheat under the best methods of tillage, and that by this process the line of winter-wheat production can be pushed far into the dry country.

In the local tests of oats at the Nebraska substation, the early-ripening varieties have uniformly produced the largest and most satisfactory yields, later varieties being injured by drought and rust. Among these early and successful varieties may be mentioned the Kherson, the Sixty-Day, and the Texas Red.

Our ordinary local barley has proved superior to any of the introduced varieties and furnishes a large quantity of grain for local consumption.

While corn is a somewhat uncertain crop in the dry region, it is also one of the most adaptable to local conditions, and there is no question about the ability of the station worker to develop varieties of corn which will be suited to the localities in which they are grown. The question as to what extent the corn crop may prepare the land for a subsequent small-grain crop should be carefully studied. I am uncertain as to the degree of drought resistance which can be produced in the corn plant, but cultivation will largely overcome the effect of drought by accumulating moisture in the soil for the use of the plant during the latter part of its growing period.

It is probable that the Kafir corns will always be more drought-resistant than the Indian corn and that they will be used for grain production in the southern portion of the Great Plains area.

I shall hope to hear a discussion during this meeting of what can be accomplished in securing crops which can actually grow and mature with a smaller quantity of water than those crops now being grown in the humid regions. If it can be demonstrated that properly selected crops can grow and mature with certainty in the dry region, producing a ton of dry matter, either grain or forage, with smaller amounts of water than our ordinary crops, this will be one of the most successful methods of pushing settlement into the semi-arid region. The durum wheats, Kafir corn, and sorghum give some promise along this line. I believe, however, it should be the work of the members of this association to determine whether these so-called drought-resistant crops actually grow and mature with less water, or whether they simply have a greater power of endurance under drought conditions, enabling them to withstand somewhat longer or more severe conditions of drought than tenderer varieties of crops.

The river valleys of this area are noted for their production of alfalfa, perhaps the most wonderful forage crop of the region. Either with or without irrigation they furnish a very large amount of forage for the winter maintenance and the fattening of cattle and sheep. Alfalfa has already extended itself in a limited way to the drier lands of this region and has demonstrated its ability to grow under dry conditions when once thoroughly established. This association should endeavor to determine the most extreme conditions under which alfalfa can be profitably grown on the high table-lands of the region, as I believe it easily possible to extend the area under alfalfa in a way which shall very greatly increase the stock-carrying capacity of the country. The successful introduction of alfalfa removes the last difficulty in the production of pork and the development of the dairy industry, two extremely profitable lines of farming which have not been much developed in this region. Alfalfa seed production also promises to be an industry which can be made highly profitable on the cheap unirrigated lands where the rainfall reaches from 10 to 20 inches per annum.

The region under consideration has developed into a great stock-growing country. The conditions of past years have very largely driven the grain grower out and allowed the cattleman and sheepman to remain. The stockman has remained because he has been able to adapt his industry to the natural conditions of the country. He has gathered what nature has produced. He has not, as a rule, expended money upon the growing of cultivated crops. His industry has been reasonably sure, but it has produced only a small revenue per acre and has not been conducive to the general settlement of the country.

Still, the fact that the grain grower has been driven from the land by adverse conditions, often more than once from the same region, is an indication to us that the settlement of the semiarid region with farmers who depend upon grain production should be well considered. Experiment stations should not be used to exploit the country and to bring into these regions men who can not or will not practice successful methods of grain growing. Intensive methods of tillage require a large expenditure for farm machinery and motive power in order to cultivate a small area of land. The average settler has not the means with which to secure this equipment; neither has he the knowledge which will enable him to put it into successful operation. The settlement of this region will progress much more rapidly and more satisfactorily if the settlers already in the country can be induced to practice somewhat better methods and to determine the success of new varieties and of new methods under farm conditions before an attempt is made to bring settlers into the country whose success is dependent upon conditions which they can not meet.

It is a mistake to assume that the climate of this region is changing permanently—that the rainfall follows the plow. While it is true that the conservation of moisture leaves more available for the crop, we have had wet years and dry years, lean years and fat years, in this region since the records of its settlement are available. The cattleman profits less by the years of abundant rainfall than the man who is growing grain. He also suffers less during the periods of drought. Having invested little in labor, seed, and farm machinery, he risks little in times of adverse conditions. His grass cures upon the ground, and he winters his cattle upon the range with limited amounts of forage which he has stored for their protection during adverse weather conditions.

But people are not content to let the cattleman occupy this region unmolested. The pressure for settlement from outside regions is continuous. The high-priced lands of the rich arable country are driving the poor man to the region of cheaper lands. It is the province of the stations in this region to determine how this settler who has already occupied the land may succeed, how he may protect himself so as not to be driven out when adverse years come upon the country, and how he may help to develop this country into one which will support a larger population and give a more certain revenue to its people. The high-priced land of older sections has increased the price of land in the Great Plains area. The cattleman can no longer expect to hold 20 or 25 acres of land for a steer. It must be grown on a much smaller area. This means that the question of forage and possibly of grains for the steer's maintenance must be studied by the cattleman himself or he will be driven from the country by the small farmer and rancher who will give more personal attention to his cattle, producing a small area of crops, but never forgetting that grass is the crop which has built up and developed the region.

The better land will be cultivated first. Probably not over 10 or 20 per cent of the land between the ninety-ninth and one hundred and fourth meridian should be under the plow. If grasses can be produced which will support more live stock than heretofore, these should gradually be introduced. Forage crops should be grown in as large areas as possible for use in wintering the live stock which is now in the country. The losses of the ranchman from the depletion of his herd in winter through starvation must be overcome. Good business sense does not permit that a man with 100 head of cattle, weighing 100,000 pounds in the fall, should permit these cattle to come through the winter with a loss of 15,000 pounds of flesh which he must regain by months of summer growth. If the steer must live off a smaller area of land it means he must reach a market weight at an earlier age. This means better feed, more continuous growth, and the use of forage instead of the open range in winter.

The experiment station worker can aid in this matter by determining the methods which will make crop production successful in this area, by determining the varieties of crops which can be produced with greatest certainty and at largest commercial profit, and by suggesting the evolution which must take place in the present farm methods in order that the settler may prosper and that homes may be built in the country upon a substantial basis.

SOME SOIL STUDIES IN DRY-LAND REGIONS.

By F. J. Alway, *Chemist, Nebraska Agricultural Experiment Station, Lincoln, Nebr.*

The soils and crops of which I shall speak to-day are those of the hard spring-wheat region of Saskatchewan, particularly those of the experimental farm at Indian Head and of the region westward to Moose Jaw, a district that has been settled, though rather sparsely, for some twenty years. I wish to speak of the conditions and crops in this district somewhat in detail, because it is, in so far as I am aware, the only part of the Great Plains area in which the so-called "dry farming" has been tried for a considerable length of time and in which it has been found to be an economic success. It is a mistake to imagine that the Great Plains region suddenly ends at the forty-ninth parallel. Strange as it may seem, this new country is able to furnish valuable data bearing on the subject that we have met to discuss. Indian Head has the only experimental farm in the Great Plains area whose records go back before the dry years of the nineties. While this northern farm may have advantages of temperature and possibly of soil not enjoyed by the greater portion of the Great Plains region, these advantages must be inconsiderable when compared with those of parts of North Dakota, and may be slight even when compared with parts of western Kansas and western Nebraska.

Before my first visit to Saskatchewan I had visited western Nebraska and western Kansas looking for evidences of successful "dry farming," and was, accordingly, somewhat familiar with the conditions of soil and vegetation of the central portion of the Great Plains area.

The extreme northern part of the Great Plains region is similar in appearance and vegetation to the prairies and plains of Nebraska and Kansas.

Very little study has been devoted to the chemical and physical properties of the soils of the northern portion of the Great Plains region, better known as the Canadian Northwest. In the few investigations that have been conducted there methods have been employed which are adapted to the humid climate of eastern Canada, but which are ill-suited to the conditions that have produced the prairies and plains.

The commonly accepted explanation of the large yields of small grains obtained in Saskatchewan is quite erroneous and has served to prevent the recognition of the value to the agricultural interests of the semiarid portions of the United States of the large amount of data contained in the annual reports of the Indian Head experimental farm, covering a period of almost twenty years. The climate of the portion of the Saskatchewan with which I will deal is distinguished from that of the prairie portions of the United States chiefly by its lower winter temperature, its slightly longer summer days, and its low precipitation, the rainfall occasionally amounting to less than 5 inches during the crop season. Both American and English authorities have advanced or accepted in explanation of the large yields of grain in that region the theory that the frost penetrates to a great depth during the winter and that during the summer months this furnishes a constant supply of moisture to the growing grain. This theory seems to be due to a confusion of the two meanings of the term " frost," as though the cold which entered the soil in the winter time changed there to frozen water. Sir William Crookes in his presidential address before the British Association for the Advancement of Science in 1908 chose as his subject "The wheat problem." In the course of his address he made the following statement:

> The fertility of the Northwest Provinces of the Dominion of Canada is due to an exceptional and curious circumstance. In winter the ground freezes to a considerable depth. Wheat is sown in the spring, generally April, when the frozen ground has become thawed to a depth of 3 inches. Under the hot sun of the short summer the grain sprouts with surprising rapidity, partly because the grains are supplied with water from the thawing depths. The summer is too short to thaw the ground thoroughly, and gate posts and other dead wood extracted in the autumn are found still frozen at their lower ends.

Sir William had passed through Saskatchewan the preceding summer. Storer, in his text book on agriculture, as an illustration of how melting ice may serve as a useful store of moisture in certain situations and for certain crops, makes the following statement regarding Assiniboia, which is now southern Saskatchewan:

> Even in late July some of the soil still holds the winter's frost at a depth of several feet below the surface. This underground layer of frozen earth is believed to explain the wonderful fertility of the soil, as the frost in gradually coming to the surface during the summer months creates a moisture which, meeting the warmth from above, forms a kind of natural hotbed. This moisture counteracts the scarcity of rain during the spring and summer and accounts for the grain being forced with such amazing rapidity after the late sowing.

Up to the present time this "frost" explanation seems to have passed without criticism.

I am convinced that the soil of the prairie and of the grain fields of Saskatchewan does not remain frozen throughout the summer at any depth. The winter of 1903–4 was the coldest that had occurred in twelve years. The winter had been unusually severe, the spring was late, and the early part of the summer cool. During the second week in July, 1904, I made borings to a depth of 9 feet in the most exposed situations that I could find. There was no trace of frost, although the soil at a depth of 6 feet was distinctly chilly to the touch. Both above and below, it was decidedly warmer. In the first part of April, 1905, I made numerous borings until the auger had passed through the frozen soil. In the exposed gardens and fallows the frost had penetrated from 4½ to 5½ feet. On the stubble it had reached a depth of only 3½ feet. The subsoil of the prairie was so dry that I could not decide how far the ground was frozen. It is probable that the frost is all out of the ground by the 1st of July of every summer, unless it be on the edges of the forest country, where the drifting leaves serve to prevent the thawing of the soil.

The fertility of the soil is apparent to any one who visits the Province of Saskatchewan at the close of a favorable crop season. It is a well-recognized fact, however, that in regions where the normal precipitation is very small, abundant crops are produced even on very coarse sands in those seasons during which the rainfall is unusually heavy and well distributed. Evidence that the soil of southern Saskatchewan is characterized by the ability to produce a high average yield of wheat, oats, barley, and potatoes for many years in succession without the application of any fertilizers or even the growing of leguminous crops is furnished by the annual reports of the Indian Head experimental farm, which has been maintained by the Canadian government since 1888. Experimental farms are maintained by the same government at four other places—Nappan in Nova Scotia, Ottawa in Ontario, Agassiz in British Columbia, and Brandon in Manitoba. The first three represent humid climates with a heavy winter precipitation, while the farms at Brandon and Indian Head are in the region of very light winter precipitation. The climate at Brandon is very similar to that at Indian Head except that the precipitation is somewhat heavier and the summer temperature somewhat higher. Part of the Brandon experimental farm is on the upland and part in the valley of the Assiniboine River, the latter being subject to occasional inundations and also, probably, to more or less subirrigation. No distinction has been made in most of the reports of the farm regarding the data inadmissible in a study of the relation of crop yield to rainfall.

In illustration of the above-mentioned characteristics, the yield of the 12 best-adapted varieties of wheat, oats, barley, potatoes, etc., during a period of from four to nine years that they have been under trial at the five Canadian farms, where the conditions of experiments are similar, are given in Table I.

TABLE I.—*Average yields of the best-adapted varieties of various crops at the five Canadian experimental farms.*[a]

Crop.	Number of varieties grown.	Averages for years 1895–1903.						Average at Indian Head in 1901.
		For the five farms.	For Ottawa farm.	For Nappan farm.	For Brandon farm.	For Indian Head farm.	For Agassiz farm.	
Oats, bushels[b]	12	76.2	64.5	77.2	88.5	94.5	67.5	132.8
Barley, 2-rowed, bushels	6	45.5	45.3	45.1	46.0	56.2	43.3	60.0
Barley, 6-rowed, bushels	6	50.8	50.1	50.6	56.0	60.5	45.9	64.0
Wheat, spring, bushels	12	34.3	28.0	36.9	35.9	42.2	34.9	63.2
Peas, bushels	12	35.7	33.6	31.9	47.3	41.5	37.5	57.7
Maize, green, tons	6	19.4	23.1	18.8	19.6	14.6	22.9	25.2
Turnips, tons	6	31.5	34.2	39.9	25.1	22.3	39.7	37.5
Mangels, tons	6	31.7	39.1	38.0	31.1	22.6	34.3	29.3
Carrots, tons	6	22.0	30.7	22.3	14.3	12.2	31.1	12.6
Sugar beets, tons	4	24.5	28.8	27.2	19.4	11.2	17.0	27.7
Potatoes, bushels	12	377.9	399.2	387.0	395.3	433.6	371.0	620.5

[a] Some of the varieties in the averages have been under trial only four years, but most of them have been tested for nine years.

[b] Bushels of 34 pounds.

It will be seen that the average yield of wheat, oats, barley, and potatoes is higher at Indian Head than at the other four farms. The yields of the same crops in 1901 are given in illustration of the effect of an unusually favorable season at Indian Head. It is important to note that only in the case of peas, in addition to the four crops mentioned, does the Indian Head farm give heavy yields. The other crops included in the table, as well as hay, produce more heavily at each of the other four farms.

The soil of the Indian Head farm is typical of that of the greater portion of the spring-wheat region of Saskatchewan. The surface soil consists in some places of bowlder clay, and in others of a very heavy lacustral deposit that had formed in the bottom of a large shallow glacial lake. The lacustral clay was not found to exceed more than 3 feet in depth on the Indian Head farm, while at Moose Jaw it exceeded 9 feet in depth in all places where samples were taken. The lacustral clay was everywhere underlaid by bowlder clay. (See Table II.)

The chemical composition of the subsoil of the district gives every evidence of the aridity of the climate, the percentage of carbonates and soluble salts being very high.

The amount of carbonates in the surface soils is in all cases less than that in the subsoil. The subsoil, judged by the content of carbon dioxid, is of two distinct types, the one carrying from 7.5 to 12 per cent and the other from 1.25 to 4 per cent. These two types of subsoil differ in physical as well as in chemical properties. The first bowlder clay carries stones and bowlders, while in the second, a clay of lacustral origin, only an occasional small stone is found. The former rapidly disintegrates in contact with water, from 1 to 3 hours' boiling being sufficient to reduce it to clean, single grains, as observed under the microscope, while the latter when treated with water breaks up into small aggregations which, when rubbed with a stirring rod, become like putty, and which require from 30 to 36 hours' boiling with water to completely resolve into their individual soil particles.

The till, or bowlder clay, possesses much lighter color, both in the wet and in the dry condition, than the lacustral clay. The dried lumps of the former can be crushed between the thumb and finger, while those of the latter can not. As is shown by the table of mechanical analyses, the till is much richer in sand and poorer in clay particles than the lacustral deposit; the proportion of silt in the two is about the same. The difference in appearance of the two types of soil when removed from fields in which a crop of grass or some cereal has just reached maturity is very marked, the till being brought to the surface by an augur in the form of powder, resembling wood ashes, while the other forms a more or less coherent mass of small aggregations. One of the most important and characteristic properties in which the two types differ is the hygroscopic coefficient of the subsoil. The surface soil, on account of the humus it contains, possesses a high coefficient, no matter to which type it belongs. In the case of the subsoils that of the till has a value between 3.9 and 6, and that of the lacustral clay lies between 10.3 and 14.7. A careful examination of the samples whose coefficient lay between 5.8 and 10.8 showed that they were mixtures of the two types.

TABLE II.—*Mechanical analyses of specimens of the two soil types at the experimental farm at Indian Head, Saskatchewan.*

Character of soil.	Bowlder clay.	Lacustral clay.
	Per cent.	*Per cent.*
Gravel, 2 to 1 mm	1.7	0.0
Coarse sand, 1 to 0.5 mm	5.2	0.01
Medium sand, 0.5 to 0.25 mm	5.6	0.01
Fine sand, 0.25 to 0.10 mm	14.1	2.2
Very fine sand, 0.10 to 0.05 mm	12.3	6.7
Coarse silt, 0.05 to 0.016 mm	16.2	19.0
Fine silt, 0.016 to 0.005 mm	19.5	22.6
Clay, less than 0.005 mm	26.1	48.2
Total	100.7	98.8

In most of the fields examined on the Indian Head experimental farm the surface soil seemed to consist of a mixture of the two types. This is probably due to a combination of three causes, viz, (1) high winds, which blow soil from the surface of one type over the surface of the other; (2) the action of the plow where the layer of the lacustral clay is very shallow; (3) the work of burrowing animals which carry bowlder clay subsoil to the surface and deposit it upon the lacustral clay.

I made analyses of samples of soil taken from each of the first 6 feet of a field of 10 acres that had never been fertilized. The field had been in fallow in 1904, and in 1905 bore a crop of spring wheat yielding on an average per acre over 46 bushels. The samples were secured in November, 1905. The amount of nitrogen in the surface foot of soil was large, amounting to about one-fourth of 1 per cent. The percentage of potash was high, and that of phosphoric acid was fairly high at all depths. The percentage of calcium carbonate below the first foot was very high, varying from 15 to 20 per cent. While the chemical analysis indicates this to be a fertile soil, there is nothing in its chemical composition to explain the remarkable crop yields that have been obtained.

There can be no doubt as to the semiaridity of the climate of southern Saskatchewan when an examination is made of the records of the meteorological stations which have been maintained there for the past twenty-three years by the Canadian government. A station has been maintained on the Indian Head farm since 1890, in latitude 50° 28′ and longitude west 103° 40′. It is 1,924 feet above sea level.

TABLE III.—*Rainfall and snowfall at Indian Head, Saskatchewan, in inches.*

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total rainfall.	Total snowfall.	Total precipitation (10 inches snow = 1 inch rain).	Total rainfall of crop season.
1890	.....	.....	.....	0.51	0.80	4.48	3.01	2.16	1.05	1.37	.....	.....	15.40	......	......	10.09
1891	.....	.....	.....	.00	.97	6.19	3.84	2.14	.86	.03	.....	.....	14.03	......	......	13.14
1892	.....	.....	.....	.60	.82	2.59	1.09	.89	.93	1.40	.....	.....	6.92	......	......	5.10
1893	.....	.....	.....	.00	3.17	4.60	2.12	.12	.10	.90	.....	.....	11.01	......	......	[illegible].89
1894	.....	.....	.....	1.20	.30	.80	.57	1.03	.....	.....	.....	.....	3.90	......	......	2.87
1895	.....	.....	.....	.00	2.10	3.95	3.82	.60	1.60	.10	0.90	0.90	12.17	......	......	10.37
1896	.....	0.05	0.00	1.75	2.83	4.32	1.90	1.39	.60	.00	1.40	.15	11.19	......	......	10.23
1897	0.25	.50	.30	.00	.00	11.20	1.52	1.30	.20	.80	1.30	.00	13.45	27.5	16.20	12.74
1898	.40	.30	.60	1.05	.50	4.14	3.36	4.00	4.03	1.85	.40	.00	18.03	26.0	20.63	9.75
1899	.40	.00	1.00	.50	2.15	5.24	.40	.90	1.15	1.20	.30	.40	9.64	41.0	13.74	9.19
1900	.10	.55	.45	.27	.80	.65	1.73	4.85	3.81	.50	1.00	.80	12.21	32.5	15.46	3.45
1901	1.50	.35	.20	1.71	.87	5.63	5.82	.00	5.10	1.58	.00	.50	17.76	55.0	23.26	12.38
1902	.00	1.40	1.35	.87	3.87	4.96	.67	.57	.42	.00	.60	1.30	10.71	53.0	16.00	9.78
1903	.40	.10	.35	.16	4.08	1.29	4.23	4.16	1.26	.40	1.10	1.40	15.48	34.5	18.93	12.50
1904	.85	2.25	3.30	.54	1.94	2.76	3.81	1.17	1.79	.32	.38	1.00	11.92	81.3	20.05	8.74
1905	.25	.45	.91	.57	3.34	5.16	2.47	2.23	5.00	.54	.....	.....	19.31	......	......	12.49
Average	.41	.61	.84	.61	1.78	4.25	2.52	1.72	1.74	.73	74	.64	12.69	......	16.55	9.54
Lowest	.00	.00	.00	.00	.00	.65	.40	.00	.10	.00	.00	.00	3.90	26.0	......	2.87
Highest	1.50	2.25	3.30	1.75	4.08	11.20	5.82	4.85	5.10	1.85	1.40	1.40	19.31	81.3	......	13.14

In Table III the rainfall and snowfall at Indian Head are given in so far as these are available. There is no record of the rainfall at this station prior to 1890, and the snowfall previous to 1895 was not recorded. The records of the neighboring stations of Regina and Qu'Appelle, dating from 1885, indicate that the climate from 1885 to 1890 was similar in character to that from 1890 to 1895. However, the precipitation records of these stations should not be used in seeking a relation between rainfall and crop yield at Indian Head. There may be enough difference in the rainfall at two different places 20 miles apart to account for a poor crop at one place and a good crop at the other. Accordingly, in the consideration of the crop yields at Indian Head I use only the data for the years beginning with 1890.

Practically the whole of the precipitation from November to March, inclusive, is in the form of snow. It seems improbable that the snow which falls between the time when the ground freezes in the autumn and the time when it melts in the spring has much influence on the relative yield of spring-sown cereal crops except in so far as it favors germination of the seed. The snowfall is regarded in the table as melted snow (10 inches of snow equals 1 inch of rain). Over half the rain falls during the months of June and July, and over three-fourths between the time of seeding and that of harvest. There is, however, great variation from year to year in the precipitation of any one month, as is shown in the last two lines of the table.

The heaviest rainfall of any crop season occurred in 1891, it being 13.14 inches, closely followed by that of the years 1897, 1901, 1903, and 1905, when it was between 12 and 13 inches. The lightest rainfalls occurred during the crop season of 1894 (2.87 inches), 1892 (5.10 inches), and 1900 (3.45 inches for crop season of wheat, 4.18 inches for that of oats, and 5.86 inches for that of barley). In 1892 and 1894 the rainfall of the crop season was the same for all three crops. The yields of field crops of wheat, oats, and barley, sown on fallow in these dry years, were as follows:

TABLE IV.—*Yields at Indian Head during the three dry years 1892, 1894, and 1900.*

Year.	Rainfall of crop season.	Wheat.	Oats.	Barley.
	Inches.	*Bu. lbs.*	*Bu. lbs.*	*Bu. lbs.*
1892	5.10	29 9	42 ..	45 9
1894	2.87	16 46	26 17	16 29
1900	3.45	15 43	55 ..	35 24

The summers of 1894 and 1900 were characterized by high temperatures with hot winds. In the summer of 1894 the temperature often reached 95° to 100° F. In 1900 on June 21, 22, and 23 the thermometer registered maximum temperatures of 101.5°, 106°, and 103°. From Table IV it will be seen that high temperatures are not uncommon at Indian Head. The instances of unusually heavy precipitation in April have been in the form of snow, and those in October in that of rain. Rains of such a torrential character as to cause a considerable run-off from level plowed fields have been rare, those of June, 1897, being probably the only ones during the past seventeen years. The precipitation of this summer was so unusual that I quote the following description from the annual report of the station:

> In the season of 1897 less than 1 one-hundredth of an inch of rain fell between the 1st of April and the 14th of June. Seeding commenced on the 16th of April and continued without intermission until completed. High and continuous winds were prevalent during the last week in April, the whole of May, and from the 1st to the 15th of June. On June 14 0.6 inch of rain fell; on the following day within nine and one-half hours 6.6 inches fell. Twenty-seven hours after this downpour ceased a rain began, lasting two hours, during which 0.9 inch fell, making 10.6 inches within five days. The greater portion of this rain flowed over the land to the coulées, thence to the Qu'Appelle River. The rainfall amounted to 2.12 inches between June 17 and harvest, which began on August 12 for barley, August 16 for wheat, and August 26 for oats. This amount was distributed as follows: June 27 (0.6 inch), July 4 (0.5 inch), 5 (0.1 inch), 7 (0.15 inch), 8 (0.4 inch), 10 (0.2 inch), and 23 (0.17 inch). No rain fell during August previous to the 26th.

In Table V are given the mean monthly temperatures for both North Platte and Indian Head. The differences in the winter time are great, but those in the summer are very much smaller.

TABLE V.—*Average mean temperature at Indian Head, Saskatchewan, and at North Platte, Nebr.*

Month.	Indian Head.	North Platte.	Difference.
	°F.	*°F.*	*°F.*
January	4	20	16
February	5	25	20
March	17	35	18
April	41	49	8
May	54	58	4
June	65	68	3
July	68	74	6
August	66	71	5
September	58	62	4
October	42	50	8
November	22	35	13
December	12	27	15
Year	38	48	10

In Table VI we have the annual maximum and minimum temperatures at Indian Head. While the minimum temperature is very low, the maximum temperature is generally quite high, sometimes exceeding 100° F.

TABLE VI.—*Maximum and minimum temperatures at Indian Head, Saskatchewan, from 1890 to 1906, inclusive.*

Year.	Maximum.	Minimum.
	° F.	*° F.*
1890	95	−40
1891	85	−42
1892	98	−44
1893	100	−52
1894	100	−39
1895	95	−38
1896	96	−38
1897	92	−48
1898	99	−32
1899	95	−43
1900	106	−37
1901	94	−37
1902	90	−35
1903	92	−42
1904	92	−47
1905	88	−43
1906	99	−38

In Table VII we have the mean monthly precipitation at Indian Head and at North Platte. The precipitation is similarly distributed, but is higher at North Platte.

TABLE VII.—*Average precipitation at Indian Head, Saskatchewan, and at North Platte, Nebr., from 1890 to 1906, inclusive.*

Month.	Indian Head.	North Platte.
	Inches.	*Inches.*
January	0.41	0.47
February	.61	.42
March	.84	.75
April	.61	2.17
May	1.78	2.70
June	4.25	3.42
July	2.52	2.74
August	1.72	2.42
September	1.74	1.28
October	.73	.98
November	.74	.35
December	.64	.57
Total	16.55	18.27

The Indian Head experimental farm consists of 682 acres. In 1882 a large farming company broke up 640 acres. From that time until the Canadian government took possession in 1888 the entire section was in crop each year. Mr. Mackay, a farmer living in the district since 1882, was placed in charge of it as superintendent and still continues in that position. In his annual report for 1889 he stated that experience had shown that there was only one successful way in which crops could be raised on the prairies of western Canada, and that was by the use of the summer fallow for the purpose of storing moisture:

> In this portion of the territories, at least, every settler knows the importance of properly preparing his land. For several years after the country became

> open for settlement everyone imagined that grain would grow, no matter how put in, but now the man is devoid of reason who thinks he is sure of a crop without any exertion on his part. It is true that we have had one year since 1882 that required little or no preparation to give a most abundant crop, but too many know how little was received in the remaining years by poor cultivation.
>
> Our seasons point to only one way in which we can in all years expect to reap something. It is quite within the bounds of probability that some other and perhaps more successful method may be found, but at present I submit that fallowing the land is the best preparation to insure a crop. Fallowing land is not required in this country for the purpose of renovating it, as is the case with worn-out lands in the east, and it is a question yet unsettled how much or how little the fallows should be worked, but as we have only one wet season during the year, it is found beyond doubt that the land must be plowed the first time before this wet season is over if we expect to reap a crop the following year. This wet season comes during June or July, at a time when every farmer has little or nothing to do, and then this work should be done. Usually seeding is over by the 1st of May, and to have the best results the land for fallow should be plowed from 5 to 7 inches deep as soon after this as possible. Land plowed after July is of no use whatever, unless there is rain in August, which very seldom comes to any great extent. A good harrowing should succeed the plowing, and all weeds or volunteer grain should be kept down by successive cultivations.

Almost the same statements appear in Mr. Mackay's last annual report, that of 1905:

> It is very gratifying to know that throughout the territories summer fallowing is rapidly becoming general. No matter where farming is carried on, the farmers realize that to be sure of a crop they must prepare a portion of their land the year before the crop is grown; and apart from the value of the stored moisture there is the inestimable advantage of keeping weeds from overrunning the farm. The true worth of properly prepared fallows has been clearly demonstrated in past years in every grain-growing district of Assiniboia.
>
> As has been pointed out in my previous reports, early and thorough work on fallows is absolutely necessary to success.

The minister of agriculture of the Province of Saskatchewan has recently stated in a published address that successful wheat growing in Saskatchewan depends upon the intelligent use of the fallow:

> If one is to attain the greatest success in the cultivation of wheat on the western prairie, there are at least three outstanding questions that demand intelligent study and prompt action, and these are soil moisture, good seed, and weeds.
>
> Taking the average year and the average prairie, soil moisture is by far the most important question that should engage the active attention of the farmer. Because of this, bare summer fallowing is becoming, and, indeed, in many parts has already become, the very foundation upon which successful wheat culture is based and profitably carried on. True, there are many dissenters from this, but these are invariably from localities where the rainfall is more abundant and fall plowing has met with a good measure of success.
>
> During the past twenty-five years there has not been sufficient moisture, taking one year with another, to grow a crop each consecutive year; hence the

> necessity of stopping every third or fourth year and catching up, as it were, with the supply of moisture that can be stored up in the soil during a season of bare fallowing.
>
> The practice of summer fallowing is usually associated in the popular mind with the restoration of fertility; but not so in the West. Conservation of soil moisture is the primary object of bare fallowing.

The crops that have been found to regularly reach maturity and to be well adapted to the climate are spring wheat, oats, barley, peas, flax, buckwheat, native grasses, brome-grass, potatoes, and field roots. Red and alsike clovers do well when partially protected by snow during the winter. Alfalfa in field lots has not as yet, on account of lack of inoculation, had a thorough trial. Winter wheat has usually been entirely destroyed by the alternate thawing and freezing during April. Early varieties of Indian corn do not usually mature seed, but they are far enough advanced before the advent of frost to make good ensilage.

The crop season at Indian Head may be considered to extend from the time that the soil is sufficiently thawed on the surface to permit of the use of drills or harrows until the grain sown in reasonable season is ripe. Frequently the wheat sown late is caught by frost. The earliest recorded date of the beginning of seeding at Indian Head is March 22, 1894, and the latest, with probably the exception of this year, May 7, 1901. The present year shows a very late beginning of seeding, the bulk of the wheat crop having been sown between May 15 and May 31. The earliest harvest on record, namely, that of oats, began July 25, 1894, and the latest, that of wheat, on September 4, 1891. The average date since 1889 of the beginning of harvest in the case of barley is August 17; of oats, August 20; and of wheat, August 21. The growth of cereals in Saskatchewan is not nearly so rapid, in comparison with that of other places, as is popularly believed. The average length of time from seeding until harvest for the four grain crops is greater at Indian Head than at Brandon, Ottawa, or Nappan in Nova Scotia, as shown in Table VIII.

TABLE VIII.—*Average length of time from seeding until harvest at different experimental farms in Canada.*

Location of farm.	Barley.	Oats.	Wheat.	Peas.
	Days.	*Days.*	*Days.*	*Days.*
Indian Head	98	110	127	116
Brandon	92	105	118	120
Ottawa	97	110	117	116
Nappan	93	109	114	111
Agassiz	106	118	118	122

The length of the day in the summer time is not so remarkably long, as is evident when it is remembered that London is farther north than Indian Head. It is true that in the Peace and Slave river districts the night is short, but these are several hundred miles north of where wheat growing is as yet practiced on any considerable scale.

As the greater portion of the farm at Indian Head is used either in experimenting with different varieties of cereals, grasses, and legumes or for the production of seed of the best-adapted varieties for government distribution throughout the western provinces, each grain crop is usually followed by a year of clean cultivation, to destroy all weeds, grasses, and especially volunteer grain. The year of clean cultivation, termed summer fallow, consists of deep plowing in May or June, followed by three or four harrowings during the summer. In the ensuing spring grain is drilled into the soil without preliminary preparation. Corn and root crops are preceded by, but not followed by, fallow. When the soil has been cultivated long enough to cause it to drift during high winds, the land is seeded with brome-grass or western rye-grass, and after two or three years is treated like virgin prairie sod. When the year of fallow has been followed by more than two crops of grain in succession, the yield of the third and subsequent crops has usually been so much smaller than when the land has been fallowed every third year that the practice is considered unprofitable. In general, however, the farmers in Saskatchewan employ the fallow only every fourth or fifth year, and then carry it out so poorly that at the end of July, in 1904, very few properly worked fallows were to be seen in a journey of several hundred miles through the grain-producing country.

In Table IX is shown the yield of wheat, oats, and barley both on fallow and on stubble since 1889 at Indian Head.

TABLE IX.—*Yield per acre of cereal crops at Indian Head, Saskatchewan, on fallowed land and on stubble field.*

Year.	On fallow.			On stubble.			Excess due to fallowing.				Rainfall of previous autumn.
	Wheat.	Oats.	Barley.	Wheat.	Oats.	Barley.	Wheat.	Oats.	Barley.	Average.	
	Bush.	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Bush.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Inches.*
1890	35.3	....	....	....	....	....	....	....	....	....	....
1891	49.2	83.6	47.1	....	....	....	....	....	....	....	....
1892	29.2	42.0	45.2	....	....	....	....	....	....	....	....
1893	36.1	77.0	46.8	27.9	63.2	40.4	29	22	16	22	3.22
1894	16.8	26.5	16.6	7.5	10.1	6.8	124	162	144	143	1.12
1895	41.3	104.6	55.1	28.1	37.6	31.7	47	178	74	100	1.03
1896	40.1	95.5	57.8	29.7	....	....	35	....	....	35	1.70
1897	30.9	66.8	49.0	25.3	....	....	22	....	....	22	.60
1898	29.1	82.7	41.8	....	....	....	....	....	....	....	2.30
1899	32.4	75.8	46.8	28.9	....	....	12	....	....	12	8.88
1900	15.7	55.0	35.5	5.4	10.4	7.6	191	429	365	329	2.35
1901	41.7	100.0	52.2	38.4	90.0	49.2	8	11	5	8	9.16
1902	33.4	76.0	58.2	25.5	43.6	25.5	31	74	128	111	6.68
1903	35.8	94.0	54.6	15.4	43.8	18.7	132	115	192	146	.42
1904	39.4	75.5	43.1	30.3	62.1	36.8	30	21	17	23	1.66
1905	40.0	90.9	63.3	23.3	47.4	43.5	72	92	46	70	2.01

In the case of several years there evidently was no wheat sown on stubble at the experimental farm. In general there is little difference between the average yield on all plats and that on the fields, the greater adaptability of the varieties sown as field crops compensating for the usual advantages enjoyed by the plat experiments, on which many varieties are sown that are ill adapted to the climate. You will notice that in all cases the high yields have been obtained from the fallows. The year 1905, while not giving the highest yields at Indian Head, was in many respects ideal, and the relation of the yield of wheat on stubble to that on fallow may be considered a normal one.

When the annual yields are compared with the precipitation of the corresponding crop season, it is to be seen that the yield of grain on fallow varies in general with the rainfall of the crop season, but shows a closer dependence upon the total available moisture, which I will speak of a little later. The greatest difference between the yields on fallow and on stubble is to be observed in the case of those seasons that have been preceded by a normally dry autumn. In the case of the two years 1898 and 1900, in which the rainfall following the ripening of crops amounted to approximately 9 inches, the yields of the following years, 1899 and 1901, were about the same on stubble as on fallow. The explanation of the disappearance of the difference between stubble and fallow when the season had been preceded by a wet autumn is the following: During the summer large quantities of nitrates are formed and are stored up within reach of the plant roots, in the case of the fallow fields, so that crops on fallow under normal conditions are supplied with a large quantity of nitrates and an abundance of moisture, while those on stubble have neither such a supply of nitrates nor much moisture. A heavy rainfall in autumn carries the nitrates in the fallow fields below the reach of the plant roots and at the same time charges the stubble fields with moisture, thus putting the stubble in a condition similar to that of the fallow as regards water and nitrates.

A very light rainfall during the months of July and August when the rainfall of May and June has been abundant causes a comparatively light yield of straw, together with a good yield of grain, as shown by Table X.

TABLE X.—*Average yield of the field lots of grain at Indian Head, Saskatchewan, in years in which the rainfall of July and August was light, 1892 to 1902, inclusive.*

Year.	Rainfall of April, May, June.	Rainfall from July 1 to harvest.	Yield.					
			Wheat.		Oats.		Barley.	
	Inches.	*Inches.*	*Bu.*	*lbs.*	*Bu.*	*lbs.*	*Bu.*	*lbs.*
1892	4.01	1.98	29	12	42	16	46	32
1893	7.77	2.24	36	6	67	1	45	36
1896	8.90	3.29	30	35	96	27	59	31
1897	11.20	1.52	30	53	67	24	50	27
1899	7.89	1.80	32	27	76	26	48	15
1902	9.70	1.24	33	25	76	33	44	23

I have been unable to find any connection between the winter temperatures and the yields of the following season.

By far the most interesting results of my investigations are those dealing with the amount of moisture existing in what may be called an available form in the grass, fallow, and stubble fields, as determined foot by foot to a depth of 6 feet. In Table XI there is shown the number of tons of free water in each acre-foot of different fields at Indian Head and Moose Jaw.

TABLE XI.—*Available moisture in fallowed fields at Indian Head and Moose Jaw, Saskatchewan, compared with that in fields that have just brought a cereal or grass crop to maturity. The water is expressed as tons per acre-foot.*

Field.	Date.	First foot.	Second foot.	Third foot.	Fourth foot.	Fifth foot.	Sixth foot.	Total.
		Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
A	July 25, 1904	127	75	97	112	84	101	596
A	September 4, 1905	268	157	167	177	170	152	1,091
	Excess in second year	141	82	70	65	86	51	495
B	July 25, 1904	291	184	196	199	236	194	1,800
B	September 5, 1905	179	95	77	69	167	211	798
	Excess in fallow	112	89	119	130	69	17	502
D	July 25, 1904	350	272	279	216	144	....	1,261
D	September 5, 1905	270	158	144	97	182	....	734
	Excess in fallow	80	114	135	119	38	....	527
F	September 9, 1905	162	412	360	266	236	231	1,667
G	September 9, 1905	144	99	104	194	213	228	982
	Excess in fallow	18	313	256	72	23	3	685

The samples were obtained by the writer in July, 1904, and in September, 1905, a 1½-inch extension auger being used for the purpose. A large number of samples would have been desirable, but the difficulty of carrying on the investigations when the drying of the samples had to be done at a distance of over 1,000 miles from the fields limited the number of determinations. That the samples in which the water was determined were fair specimens of the various fields at the different depths was confirmed by the careful examination on the spot of the soil from similar depths in various parts of the fields. The samples are the average of the foot section from two or more holes in the same field, the soil being weighed as soon as removed and placed in light cotton sacks of known weight and later dried at 100° C. Duplicates of each sample were taken.

A whole series of samples was secured for me by Mr. Reynolds, accountant at the Indian Head farm, in November, 1904, just before the ground froze. It was hoped that these would yield valuable information as to the distribution of moisture in the subsoil at the beginning of winter. While the samples were being brought to an air-dry condition at Indian Head preparatory to shipping, they were so tampered with that many of them were rendered of no value. Accordingly the whole series has been omitted from consideration.

The distance to which the bare soil at the edges of the fields exerted an influence upon the crop was readily seen in the case of grass fields, where the dark-green color and rank growth at the extreme edge stood in sharp contrast with the light-green color and weaker growth of the plants that were from 2 to 3 feet away. Through this short distance there was a gradual change in the appearance of the grass, but the plants farther in seemed to derive no benefit from the bare edges. In the case of each field all holes were bored at a distance of not less than 10 feet (usually more than 12) from the edge. Those from which samples for any one field were obtained were from 6 to 20 feet apart, it being necessary in most cases to make several borings before reaching the desired depth, the stones of the bowlder clay stopping the auger. In all the fields, while the depth to which the moisture from recent rains had penetrated varied somewhat, the succession of changes in the moisture content of the soil below the third foot was similar in all parts of the same field. In two fields of brome-grass all borings were stopped by stones within 3 feet of the surface.

Field A was seeded with western rye-grass (a native) in 1901, and has been cut for hay every year since, being mown about July 23, 1904, and July 13, 1905. No plants other than those of rye-grass were found within a distance of 3 feet of any of the holes. The growth of the grass in 1904 showed that it had suffered from an insufficient supply of water. Between the eighteenth and sixtieth inches the moisture content had probably been reduced to its minimum. From the sixtieth to the seventy-second inch the moisture content rose rapidly, the soil of the first 6 inches resembling wood ashes, while that of the last 6 inches was moist and sticky. In 1904 the rainfall between June 12 and July 1 amounted to only 0.39 inch. From the latter date until the samples were taken it amounted to 1.45 inches, occurring as follows: July 1, 0.1 inch; 12, 0.22 inch; 13, 0.93 inch; 16, 0.05 inch, and 17, 0.15 inch. The moist condition of the surface foot indicated that the water from the rain of July 13 was still largely retained at the time of sampling. No data are available to indicate to what extent the moisture content of the surface foot may be reduced by rye-grass. In 1905, between July 15 and the time of sampling, 4.26 inches of rain fell. Assuming that on the latter date the soil was as dry as on July 25, 1904, and that the weight of an acre-foot of dry soil is 3,348,000 pounds, the soil moisture available for rye-grass has been increased by 495 tons per acre when the rainfall amounted to 484 tons per acre.

Field B, which is just north of A, the two being separated by a roadway, had produced about 10 tons per acre of carrots in 1903 and was in fallow in 1904. In 1905 it bore a very heavy crop of oats (8,280 pounds of dry matter per acre). These had been cut a few days previous to the sampling. The straw, which was very heavy, had been badly lodged. At all depths in 1904 the soil was very moist, but in 1905, while the recent rain of August 30 and 31 (1.28 inches) had moistened the soil to a depth of from 18 to 30 inches, the deeper portions of the subsoil resembled the subsoil of the rye-grass field in the preceding year. It was driest at a depth of 30 to 40 inches, gradually becoming moister from the fortieth to the sixtieth inch, and rapidly from the sixtieth to the seventy-second. As the recent rain had raised the moisture content of the first 2 feet, an allowance should be made in estimating the lowest limit of soil moisture permitting of the growth of oats. This may be safely placed at 18 per cent for the first foot. A pot experiment in which barley was grown in this surface soil showed that the plants wilted when the water content of the soil fell to 18 per cent. There was a difference of 502 tons of water per acre to a depth of 6 feet between the two dates of sampling, equivalent to 4.5 inches of rain. This probably represents the approximate storage capacity for water of this type of soil in the case of an oat crop.

Field C, which was about 300 yards south of A, had been in fallow in 1898, in wheat in 1899, in barley in 1900, in oats in 1901, in wheat in 1902, and in barley in 1903. It bore a crop of oats at the time of sampling in 1904. The crop, which at the time was in head, was very short in the straw and somewhat yellow in color, this field being selected for sampling because it showed the effects of the drought more than any other field bearing a cereal crop on the farm. The soil appeared about equally moist at all depths below the surface foot in 1904, while in the following year the moisture was lowest at a depth of from 30 to 42 inches, increasing gradually from the forty-second to the sixtieth inch and seeming uniform between the sixtieth and the seventy-second inch. The crop of wheat, which was in shock at the time of sampling in 1905, yielded, as determined later, 18 bushels and 24 pounds of grain and 1,056 pounds of straw to the acre.

Field D, which lay adjoining C on the south, had been alternately in wheat and in fallow since 1898, being in fallow in 1904 and in wheat in 1905. At the time of sampling in the latter year the crop was in shock. The soil was moist at all depths in 1904 and to a depth of about 2 feet in 1905. In the latter year, from the twenty-sixth to the forty-second inch it was very dry but became gradually moister from the latter depth to the sixtieth inch, the sixth foot seeming very uniform in moisture. The straw, which had not lodged, had been cut to leave a stubble from 8 to 10 inches long. The moisture in the upper 3 feet had evidently not been reduced to its minimum. As the soil of the field to this depth was in origin and character similar to that of field F, while the latter had not received so much rain during the later portion of the growing season, field F is to be considered as better representing the lower limit of moisture for this type of soil. The soils from fields D and F to the depth of 3 feet are very similar in appearance and texture and have practically the same hygroscopic coefficient, viz, 13.0. Field D contained on July 25, 1904, within the first 5 feet of soil, 527 tons of water more than on September 5, 1905. The yield of this field for 1905 was 32 bushels and 46 pounds of grain and 3,724 pounds of straw.

Field E, 150 yards northwest of B, had been in fallow in 1904. At the time of sampling in 1905 the crop of wheat was in shock. It had lodged badly and the stubble had been left 10 to 12 inches long. The yield of grain was 15 bushels per acre and of straw 6,000 pounds per acre. The soil was moist to a depth of 18 inches on a very low ridge that traversed the field from north to south and to a depth of 24 to 36 inches at the foot of the ridge. At depths below the third foot no difference was observed between the moisture of the soil on the ridge and that in the depression. It was very dry to a depth of 42 inches, becoming gradually moister to the sixtieth inch, and seeming uniform throughout the sixth foot.

F and G were adjoining fields on the same farm, 1 mile south of Moose Jaw. These fields were selected because they promised to give the extremes of moisture, one being an unusually clean summer fallow and the other bearing a very heavy crop of wheat, which was in shock at the time. The soil was typical of a large plain of lacustral origin, the soil of which is very uniform over a great area, the underlying bowlder clay being exposed only in ravines. The uniform character of the soil is well illustrated by the hygroscopic coefficient of the twelve samples. These all lie between 11.4 and 11.8 for the third, fourth, fifth, and sixth foot sections, and a little higher for the first and second foot sections. The rainfall of 1904 at the Moose Jaw Meteorological Station, 1 mile distant, was 7.67 inches, and that of 1905 up to the time of sampling 13.03 inches. The precipitation of the latter year between July 30 and September 9 was only 0.78 inch, distributed as follows: August 1, 0.01 inch; 2, 0.28 inch; 3, 0.18 inch; 15, 0.01 inch; 26, 0.11 inch, and 28, 0.19 inch. With such a small rainfall during the last month of its growth it is probable that the heavy crop on field F, estimated at about 6,000 pounds per acre, had nearly exhausted the surface foot of available moisture before the light showers of August 26 and 28 fell. The fallow field G within the first 5 feet contained 682 tons per acre of free water (equal to 6 inches of rain) more than the adjoining field that had produced a crop. The wheat roots had not drawn as heavily upon the fourth and fifth feet as upon those above, nor had the season's rainfall been sufficiently conserved to raise to near its maximum limit the moisture content of the soil below the third foot in the case of the fallow field. It should be noted, however, that the season of 1905 with an exceptionally well-distributed rainfall had not been favorable for the reduction of the soil moisture to its minimum, and that, further, the previous year had not had a sufficiently heavy rainfall to raise the moisture content of the first 4 feet to its maximum, even if surface evaporation had been entirely prevented. In the case of the fallow field about half the rainfall for the season had been stored, chiefly below the first foot. This amount of water would be sufficient to produce 20 bushels of wheat per acre if no surface evaporation took place and the ratio of grain to straw were 1 to 1.5. The writer determined the ratio of grain to straw (dried at 100° C. in each case) on field F, as well as on an adjoining field of wheat that had also produced wheat in 1904. The ratio of the grain to the straw was 1 to 1.35 on field F and 1 to 1.31 on the stubble field. The stubble, which was about 8 inches long on the latter and 12 inches on the stubble field, was about half as heavy as on field F. The whole crop on this farm consisted of 200 acres on fallow and 200 acres on stubble. The yield of the different fields was not determined, but that from the 400 acres was 12,000 bushels of wheat. The crop on fallow was very uniform, as was also that on stubble. The yields may be considered as 40 and 20 bushels per acre, respectively.

The calculation of the amounts of "available water" given in Table IX was based on the following asumptions:

(1) That the weight of an acre-foot of ground is 3,348,000 pounds.

(2) That the samples secured were representative of the different fields.

(3) That the available moisture is the difference between the total moisture content, as determined by drying at 100° C., and the maximum amount of hygroscopic water that is taken up by a soil when exposed to a saturated atmosphere. The latter, expressed as the hygroscopic coefficient (the amount of moisture held by 100 grams of dry soil, calculated as dried at 100° C.), was determined by Hilgard's method.

The first two assumptions may safely be considered as approximately correct; a difference of 10 to 15 tons of water per acre-foot may well be attributed to the lack of accuracy in the methods and in the assumptions. Differences of 50 to 100 tons of water per acre-foot can not justly be so explained. In the case of nearly all moisture determinations hitherto published the hygroscopic coefficient of the soil has not been determined, thus rendering the results of little value. Only the difference between the total water and the hygroscopic water (in a saturated atmosphere) is, even under the most favorable circumstances, available for plant growth. The hygroscopic water in air-dry soil is not a constant, as it depends both upon the temperature and upon the humidity of the atmosphere with which it is in contact. The hygroscopic coefficient, on the other hand, is, according to Hilgard, a constant for a definite temperature, varying only by small fractions for temperatures between 7° and 23° C. It is also a critical point in relation to plant growth. Pfeffer states that "plants slowly die if the leaves are freely exposed while the roots and soil are kept in saturated air." If the leaves as well as the roots and soil are kept in a saturated atmosphere the plants live but make no growth. As all growth ceases and, except under the unusual circumstance of the air being saturated with water vapor, plants begin to die as soon as the point is reached at which the soil contains only its maximum amount of hygroscopic water, there is no possibility of any hygroscopic water being used for the growth of the plants. Very few data are available showing how near to the hygroscopic moisture the water content of a soil may be reduced by growing plants. Only under very favorable atmospheric conditions can a plant continue its normal development after the water content is reduced to near the hygroscopic coefficient.

As illustrations of how little value determinations of the total water content of soils usually have when the hygroscopic coefficient is not determined, the data in Tables XII to XVIII are presented:

TABLE XII.—*Amount of total moisture in different fields expressed as percentage of dry soil.*

Depth.	Field A.		Field B.		Field C.		Field D.		Field E.	Field F.	Field G.
	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.	Sept. 5, 1905.	Sept. 9, 1905.	Sept. 9, 1905.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
First foot..	19.0	25.9	29.4	22.4	20.0	28.8	34.4	28.9	26.4	22.2	23.6
Second foot	14.8	20.3	14.9	16.7	22.4	19.8	29.7	22.7	14.8	18.6	36.8
Third foot.	13.9	20.9	16.4	9.2	21.6	10.9	29.5	20.9	15.4	18.0	33.2
Fourth foot	13.6	15.4	17.4	9.6	16.1	17.1	20.3	11.3	13.2	23.5	27.7
Fifth foot..	12.0	15.1	21.8	14.4	15.1	18.4	15.2	16.4	15.6	24.4	26.0
Sixth foot.	15.4	13.6	19.6	17.8	15.9	19.0	19.2	19.2	21.8	25.0	25.2
Average.	14.8	18.5	19.9	15.0	18.5	19.0	24.7	19.9	17.9	21.9	28.7

TABLE XIII.—*Relations of total moisture in first 6 feet of soil to the treatment the field had received.*

Field.	Date.	Water.	Treatment of the field.
		Per cent	
G......	September 9, 1905.....	28.7	Fallow 1905; wheat 1904; wheat or oats 1903.
D......	July 25, 1904	24.7	Fallow 1904; alternately in wheat and fallow since 1898.
F......	September 9, 1905.....	21.9	Wheat 1905; fallow 1904; wheat or oats 1903 and 1902.
B......	July 25, 1904	19.9	Fallow 1904; carrots 1903; fallow 1902.
D......	September 5, 1905.....	19.9	Wheat 1905; alternately in wheat and fallow since 1898.
C......	.....do	19.0	Wheat 1905; oats 1904; barley 1903; wheat 1902; oats 1901; barley 1900; wheat 1899; fallow 1898.
C......	July 25, 1904	18.5	Oats 1904; see above.
A......	September 4, 1905.....	18.5	Rye-grass since 1901; cut for hay July 13, 1905; very little growth after mowing.
E......	September 5, 1905.....	17.9	Wheat 1905; fallow 1904.
B......	.....do	15.0	Oats 1905; fallow 1904; carrots 1903; fallow 1902.
A......	July 25, 1904	14.8	Rye-grass since 1901; cut for hay July 23, 1904.

TABLE XIV.—*Field notes on condition of soil at time of sampling.*

Depth.	Field A.		Field B.		Field C.	
	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.
First foot	Moist	Very moist.	Very moist.	Moist	Dry	Very moist.
Second foot	Dry	Moist	Very moist.	Moist,[a] dry[b]	Moist	Moist.
Third foot	Powder	Moist	Moist	Powder	Moist	Powder.
Fourth foot	Powder	Moist	Moist	Powder	Moist	Powder,[a] moist.[b]
Fifth foot	Powder,[a] very dry.[b]	Moist	Moist	Moist	Moist	Moist.
Sixth foot	Powder,[a] moist.[b]	Moist	Moist	Moist	Moist	Very moist.

Depth.	Field D.		Field E, Sept. 5, 1905.	Field F, Sept. 9, 1905.	Field G, Sept. 9, 1905.
	July 25, 1904.	Sept. 5, 1905.			
First foot	Very moist	Moist	Very moist	Moist	Moist.
Second foot	Very moist	Moist	Moist	Dry	Very moist.
Third foot	Very moist	Dry	Powder	Dry	Very moist.
Fourth foot	Moist	Powder	Powder	Moist	Moist.
Fifth foot	Moist	Moist	Moist	Moist	Moist.
Sixth foot	Moist	Very moist	Moist	Moist	Moist.

[a] Above.

[b] Below.

TABLE XV.—*Hygroscopic coefficient of different samples.*

Depth.	Field A.		Field B.		Field C.		Field D.		Field E, Sept. 5, 1905.	Field F, Sept. 9, 1905.	Field G, Sept. 9, 1905.
	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.			
First foot	11.4	9.9	12.0	11.7	12.7	10.9	13.5	12.8	9.5	13.6	13.9
Second foot	10.3	10.9	3.9	11.0	13.2	9.7	13.5	13.1	6.9	12.7	12.2
Third foot	8.1	10.9	4.7	4.6	13.5	4.8	12.9	12.3	5.8	11.8	11.7
Fourth foot	6.9	4.7	5.5	4.5	4.6	5.4	7.4	5.5	5.8	11.9	11.8
Fifth foot	7.0	4.9	7.6	4.4	4.2	5.5	6.6	5.5	5.6	11.7	11.9
Sixth foot	8.9	4.5	8.0	5.2	5.9	4.4	6.6	6.6	10.0	11.4	11.4
Average	8.8	7.6	7.0	6.9	9.0	6.8	10.1	9.3	7.2	12.2	12.1

TABLE XVI.—*Amount of free moisture in different fields, expressed as percentage of dry soil.*

Depth.	Field A.		Field B.		Field C.		Field D.		Field E, Sept. 5, 1905.	Field F, Sept. 9, 1905.	Field G, Sept. 9, 1905.
	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.			
First foot	7.6	16.0	17.4	10.7	7.3	17.9	20.9	16.1	16.9	8.6	9.7
Second foot	4.5	9.4	11.0	5.7	9.2	10.1	16.2	9.6	7.9	5.9	24.6
Third foot	5.8	10.0	11.7	4.6	8.1	6.1	16.6	8.6	9.6	6.2	21.5
Fourth foot	6.7	10.7	11.9	4.1	11.5	11.7	12.9	5.8	7.4	11.6	15.9
Fifth foot	5.0	10.2	14.2	10.0	10.9	12.9	8.6	10.9	10.0	12.7	14.1
Sixth foot	6.5	9.1	11.6	12.6	10.0	14.6	12.6	12.6	11.8	13.6	13.8
Average	6.0	10.9	13.0	8.0	9.5	12.2	14.6	10.6	10.6	9.8	16.6

TABLE XVII.—*Relation of free moisture in first 6 feet of soil to the treatment the field had received.*

Field.	Date.	Water.	Treatment of field.
		Per cent.	
G	September 9, 1905	16.6	Fallow 1905; wheat 1904; wheat or oats 1903.
D	July 25, 1904	14.6	Fallow 1904; alternately in wheat and fallow since 1898.
B	do	13.0	Fallow 1904; carrots 1903; fallow 1902.
C	September 5, 1905	12.2	Wheat 1905; oats 1904; barley 1903; wheat 1902; oats 1901; barley 1900; wheat 1899; fallow 1898.
A	September 4, 1905	10.9	Rye-grass since 1901; cut for hay July 13, 1905.
D	September 5, 1905	10.6	Wheat 1905; alternately in wheat and fallow since 1898.
E	do	10.6	Wheat 1905; fallow 1904.
F	September 9, 1905	9.8	Wheat 1905; fallow 1904; wheat or oats 1903 and 1902.
C	July 25, 1904	9.5	Oats 1904; barley 1903; wheat 1902; oats 1901; barley 1900; wheat 1899; fallow 1898.
B	September 5, 1905	8.0	Oats 1905; fallow 1904; carrots 1903; fallow 1902.
A	July 25, 1904	6.0	Rye-grass since 1901; mown July 23, 1904.

TABLE XVIII.—*Amount of water in different fields that is probably available for the support of normal plant growth expressed as percentage of dry soil.*

Depth.	Field A.		Field B.		Field C.		Field D.		Field E.	Field F.	Field G.
	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 4, 1905.	July 25, 1904.	Sept. 5, 1905.	July 25, 1904.	Sept. 5, 1905.	Sept. 5, 1905.	Sept. 9, 1905.	Sept. 9, 1905.
	Per ct.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
First foot	1.6	10.0	11.4	4.7	1.3	11.9	14.9	10.1	10.9	2.6	3.7
Second foot	.0	3.4	6.5	.0	3.2	4.1	10.2	3.6	3.8	.0	18.6
Third foot	1.3	4.0	7.2	.1	2.1	1.6	10.6	2.6	5.1	.2	15.5
Fourth foot	2.2	6.2	7.4	.0	7.0	7.2	8.5	1.3	2.9	5.6	9.9
Fifth foot	.5	5.7	9.7	5.5	6.4	7.4	4.1	6.4	5.5	6.7	8.1
Sixth foot	2.0	6.4	7.1	8.1	5.5	10.1	8.1	8.1	7.3	7.6	7.8
Average	1.8	6.0	8.2	3.1	4.2	7.0	9.4	5.3	5.8	3.8	10.6

In Table XII the total moisture content is given. The average percentage of total moisture in the first 6 feet of field F, which had produced a very heavy crop of straw and grain with a total rainfall of 13 inches, of which less than 0.8 inch had fallen during the last five weeks of its growth, was 21.9, while that in the fallow field B (1904), which had had two years in which to store moisture, was only 19.9. From the determination of total moisture shown, it would appear that field F, with its 21.9 per cent of water, was in better condition for seeding than field B, with its 19.9 per cent. In reality, however, field B was in excellent condition, while field F was practically exhausted of all moisture that could be used by a growing cereal. In Table XIII the fields are arranged in the order of their average moisture content, so as to show what relation this bears to their previous treatment. The sample of the sixth foot section from field D in 1904 was lost before the moisture was determined. To make results comparable, I have assumed in the tables that the moisture was the same as at the same depth in the same field in 1905. The stubble field D (1905) had the same percentage of total moisture as the fallow field B (1904) on the same farm. The field C, which had been continuously cropped with cereals since 1899, had almost as much water—19 per cent in 1905 and 18.5 per cent in 1904—as the fallow field B (1904). Yet fields B, C, and D were on the same farm and B is only a few hundred yards from C and D.

That the actual determination of total moisture gives less idea of the moisture conditions of different fields than a day laborer with a 6-foot auger could obtain is evident from Table XIV, which gives my field notes on the condition of the soil at the time the samples were secured. The terms "moist" and "very moist" need no comment. The samples adhering to the auger, but not moist, are called simply "dry." Those samples designated as "powder" resembled wood ashes and barely held to the auger when the latter was carefully removed from the bore. Those that formed "very dry powder" did not adhere to the auger and were removed only with great difficulty.

Table XV gives the hygroscopic coefficient of all the samples and Table XVI the free moisture of all. Table XVII shows the relation of the average free moisture of the first 6 feet to the treatment that the different fields had received. From this it is apparent that the percentage of free water in the fallows compared with that in stubble fields explains the difference in yield. The very low percentage of moisture in the rye-grass field is due to the practically complete exhaustion of available moisture from the fifth foot and the upper half of the sixth foot. The roots of the rye-grass reached to the middle of the sixth foot, while those of the wheat and oats grown on fallows evidently ended at depths between 4 and 5 feet. In Table XVI field C occupies an anomalous position, showing a higher average per cent of free moisture on September 5, 1905, than on July 25, 1904. Evidently crops on stubble under normal climatic conditions are not able to draw as much water from the lower 3 feet as those on fallows.

While the use of the hygroscopic coefficient in calculating the amount of free water enables us to form an idea of the difference in the amounts of available water held by different soils, it does not indicate the amount that is available in such form that the plant can continue a normal growth. It is probable that the water in the second to the fifth foot of the rye-grass field A (1904) and that in the second to the fourth foot of the oat field B in 1905, or in the first 3 feet of the wheat field F in 1905, would not have supported a growth of the cereals. It is probable that the normal growth ceases when the percentage of free moisture falls to from 4 to 8 per cent, according to the soil. Barley plants were grown for 6 weeks in a glass cylinder 10 inches deep filled with surface soil from Indian Head. At the end of this time water was withheld. When the barley plant died the soil at all depths below 2 inches contained 18 to 19 per cent of water. The hygroscopic coefficient was 12. Assuming that the minimum for soils of low hygroscopic coefficient is 4.5 per cent and for those of high hygroscopic coefficient is 6 per cent, Table XVIII has been prepared to show the amount of water available for normal growth. This is merely to suggest the desirability of trying to arrive at the minimum to which the moisture in a given soil may be reduced without impairing the health of the plant. It may differ much for different plants and at different stages in the growth of the same plant. As Hilgard and Loughridge have shown, it certainly differs much for different soils.

On the basis of the above determinations it seems safe to estimate that in the case of bowlder-clay soils as much as 500 tons of available water may be stored, while in clay soils of lacustral origin the amount may be much more. In neither case is the surface foot included, as the latter is liable to lose a large part of its water through surface evaporation at a time when the plants are too small to draw heavily upon its moisture. Further, the storage capacity of the soil below the reach of the roots of the plants in question is not included.

The soil of the Indian Head farm is much more pervious to water and has a smaller water capacity than the Moose Jaw soil. It will accordingly become saturated and allow water to pass into the soil below the fifth or sixth foot more readily than the latter. This would explain why as heavy crops have been obtained at Indian Head after corn, potatoes, and field roots as on fallow, these crops not using the whole of the ordinary seasonal rainfall and they being sown on soil fully stored with water. In view of the ordinary rainfall, the methods of cultivation, the system of cropping, and the nature of the subsoil, the large crop yields obtained at the experimental farm are to be considered as those from fields that were supplied with not only the rainfall of the crop season, but also with a large part of that of the preceding season. The stored water is much more valuable than an equal amount of rain falling during the crop season, not only because it contains a large part of the nitrates formed during the preceding summer and because it increases the supply of potash and phosphoric acid by enabling the roots to penetrate more deeply, but also because it is largely secure from surface evaporation.

The total available water of the crop season in the case of crops on fallow fields, to which, as I have mentioned, the yield of total dry matter of the crops at Indian Head has been roughly proportional, I calculated by adding 5 inches to the rainfall of the crop season.

Professor Shutt, of the Canadian experimental farm, has well shown the failure of experiments which take into consideration only the first 16 inches of soil to account for the extremely favorable influence of the fallow year. He determined the amount of water in two fields on the Indian Head experimental farm once a month from the beginning of the season to the end. His results are given in Table XIX.

TABLE XIX.—*Difference in the moisture content of cropped and of fallowed soil at Indian Head in 1900, to a depth of 16 inches.*

Date of sampling.	Rainfall from first of season to date of collection.	Water in Field S A (in fallow 1900, in crop 1899).				Water in field S B (in crop 1900, in fallow 1899).				Water per acre to a depth of 18 inches.		Excess of water in field in fallow, 1900.
		1 to 8 inches.		8 to 16 inches.		1 to 8 inches.		8 to 16 inches.				
		Per cent of moist soil.	Tons per acre.	Per cent of moist soil.	Tons per acre.	Per cent of moist soil.	Tons per acre.	Per cent of moist soil.	Tons per acre.	Field in fallow, 1900.	Field in crop, 1900.	
	Inches.									*Tons.*	*Tons.*	*Tons.*
May 8	0.27	22.03	264	21.32	277	25.87	386	25.55	325	541	711	−170
June 8	1.35	23.52	288	17.81	220	26.76	341	26.68	344	508	685	−177
July 8	3.20	24.39	302	22.38	293	23.62	289	18.35	213	595	502	93
August 8	5.64	24.78	308	19.28	242	25.05	312	19.07	223	550	535	15
September 8	8.47	24.16	298	21.65	280	21.28	252	20.50	244	578	496	82
October 8	12.28	25.26	316	22.39	293	27.60	356	22.07	268	609	624	15
November 8	12.38	25.79	325	22.83	300	26.14	330	23.35	288	625	618	7

The one field, S A, had been in crop in 1899 and was fallowed in 1900, while the other field, S B, had been in fallow in 1899 and bore a cereal crop in 1900. The kind of cereal is not stated in the publication referred to, but the dates of seeding, April 30, and of harvest, August 14, are given. The only crop having these dates was a 5-acre field of oats, which had been badly injured by wind, but produced 3,843 pounds of dry matter per acre. The seasons of 1899 and 1900 were in many respects unusually favorable for the experiments. The latter part of 1899 had been very dry, as may be seen from Table III, while from the opening of spring in 1900 until August 2 only 3.45 inches of rain fell, this being the driest crop season on record at Indian Head, with the exception of that of 1894. Wheat harvest began on August 2 and oat harvest on August 3. The moisture content in fields of cereals had probably been reduced to a very low point at the end of the summer of 1899, while the rainfall of May and June had furnished the fallow with a good supply of water. April and May of 1900 were very dry. The weather was unusually unfavorable for crops on stubble, as shown by Table VII. The full benefit of the fallow was shown in 1900. Nevertheless, the greatest difference shown by the samples taken to a depth of 16 inches was only 215 tons of water per acre, equivalent to less than 2 inches of rainfall. Heavy rains on August 2 (0.73 inch) and 6 (1.4 inches), with a shower (0.05 inch) on the 7th, raised the moisture content before the samples were taken on August 8. Similarly, the taking of samples in July had been preceded by rain, 0.01 inch on July 4, 0.95 inch on the 5th, and 0.42 inch on the 6th. Dry weather had prevailed before the samples were taken in May, June, and September. The crop of oats gave 3,843 pounds of dry matter per acre. This would have required 960 tons of water (equal to 8.5 inches of rain). It is very uncertain how much the rain of August 6 to 12 (2.25 inches) had affected the crop yield. A field of 2.5 acres of oats, which ripened on August 3, yielded 4,688 pounds of dry matter per acre. It also had been injured by winds. There were only 3.45 inches of rainfall available for the crop, the rain on the day before harvest not being counted. The water required for the crop, however, was 1,172 tons per acre (equal to 10 inches of rain). A 9-acre field of oats, protected from the winds by trees, which ripened on August 10, yielded 6,273 pounds of dry matter per acre, requiring 1,568 tons of water per acre (equal to 13.7 inches of rain). The dry matter of all the fields of wheat ripening from August 2 to 9 averaged 3,333 pounds per acre. A field of wheat, ripe on August 2, yielded 3,510 pounds of dry matter per acre, requiring 8.75 inches of rain, whereas the actual rainfall of the season was only 3.45 inches, and the decrease in moisture of 16 inches of soil amounted to only 167 tons per acre (equal to 1.5 inches of rain). This would leave 3.8 inches of rain unaccounted for, even assuming that the surface evaporation was as low as that in the experiments of King. The soils of fields S A and S B, judging from the moisture content when they were driest, were not very dissimilar to those of F and G (described previously), at least to a depth of 16 inches. The season of 1905 at Moose Jaw was similar to that of 1899 at Indian Head, being such as to produce the maximum difference at the time of harvest between fallow fields and fields in grain. Further, as the water content of a soil changes little during a cold, rainless winter, the moisture should have changed but little between September, 1899, and May, 1900. The difference between fields S A and S B to a depth of 16 inches on May 8 was 170 tons per acre, and on June 8, 177 tons per acre, while that between fields F and G, to a depth of 18 inches, on September 9, 1905, was about 175 tons of free water per acre. The latter fields, however, showed a further difference of 508 tons of free water per acre between the eighteenth and sixtieth inches, at the latter depth both being equally moist. It appears probable that if the moisture content of field S A, determined to a depth of 6 feet on November 8, 1900, had been compared with that of the same field on May 8, or with that of field S B on August 8, the difference would have been much larger even than that which I found at Indian Head in the case of the same fields in different years and of adjacent fields in the same year.

The results of my investigations in Saskatchewan and my conclusions drawn from these investigations may be briefly stated. Most of the generalizations and conclusions, I believe, will apply to dry farming in western Nebraska and western Kansas where deep and retentive soils are considered. The soil in Saskatchewan does not at any depth remain frozen throughout the summer. The moisture stored in the subsoil during the previous summer, and not the frost of the preceding winter, is the cause of the high yields of cereals. These high yields have in general been obtained from fields that were during the previous season in summer fallow or in cultivated crops, such as corn and potatoes. The roots of cereal and grass crops penetrate the subsoil to a depth of from 5 to 6 feet, even in seasons of unusually heavy and well-distributed rainfall. The total yield of dry matter of wheat, oats, and barley varies as the rainfall of the crop season, but shows a still closer relation to the total available moisture of the crop season. In the case of wheat the yield of grain from fallowed fields is largely independent of the rainfall of July and August, provided the rainfall of May and June has been abundant. Investigations of the fertility of the soils in which only the first 16 to 36 inches are considered do not furnish sufficient data upon which to base generalizations; in all such investigations the composition of the soil to a depth of 5 or 6 feet should be considered. The relative fertility of different areas seems to depend upon the nature of the subsoil rather than upon that of the surface soil, the latter in general being rich enough to produce very heavy crops when the moisture conditions are favorable.

Determinations of moisture, when these are not accompanied by determinations of the hygroscopic coefficient, are of comparatively little value in most cases. In semiarid regions roots go to the stored water, and the latter does not need to be elevated to the surface foot of soil. Comparatively little water is lost by direct evaporation from the subsoil below the first 12 inches. It is folly to begin dry-land demonstration experiments without having previously secured 6, or preferably 10, feet of good soil. In dry-land experiments tillage operations should be governed by actual determinations of the moisture conditions of the subsoil. The depth to which the determinations should be made depends upon the limit of the root penetration of the crop. After some experience the mere examination of the subsoil by hand and eye will give a fair idea of the moisture conditions. Accordingly, I expect to see all progressive dry-land farmers sooner or later provide themselves with an additional set of tools, namely, three soil augers, ranging in length from 3 to 9 feet.

CROP PRODUCTION UNDER HUMID AND DRY CONDITIONS.

By E. G. Montgomery, *Agronomist, Nebraska Agricultural Experiment Station, Lincoln, Nebr.*

It is very difficult to secure reliable statistics in regard to the cost of crop production even when the most careful data are kept. This is due to the great variability in climatic conditions over which we have no control that increase or decrease the crop more or less in spite of our efforts. By referring to Table IV, giving the average cost of producing corn on the farm of the Standard Cattle Company for a period of eleven years, it will be noted that the cost varied from 11 to 29 cents per bushel. This great variation in cost was probably not due to either better or poorer methods of cultivation, but mainly to climatic conditions. As we go farther west in Nebraska we find still greater variation in the cost of production. Corn has been produced as low as 7 or 8 cents a bushel in the West, and sometimes has cost 30 or 40 cents. Western farmers years ago began to discover that there seemed to be little correlation between the crop yields and the amount of labor they put on the crops. They sometimes procured very large crops with almost no labor, and at other times everything was a complete failure no matter how carefully tended. This uncertainty of a sure return for labor is always disastrous to any class of people, and in time they are apt to depend more upon Providence than upon their own efforts for a living.

Let us investigate a little the conditions in western Nebraska which have brought about this uncertainty and examine briefly the type of farming that has developed as a result. By examining Table I, which gives the average rainfall for a period of thirty years, you will notice first a great fluctuation in the precipitation.

Table I.—*Average rainfall in different sections of Nebraska, 1876–1906.*

Year.	Southwest.	West.	Northwest.
	Inches.	*Inches.*	*Inches.*
1876	9.89	10.69	16.25
1877	19.38	20.11	12.46
1878	25.54	13.76	28.92
1879	27.03	21.05	16.32
1880	21.07	17.64	13.18
1881	35.48	22.93	18.15

TABLE I.—*Average rainfall in different sections of Nebraska, 1876–1906*—Cont'd.

Year.	South-west.	West.	North-west.
	Inches.	*Inches.*	*Inches.*
1882	25.94	17.95	17.54
1883	31.17	30.01	24.36
1884	26.94	13.53	13.81
1885	33.28	22.03	18.81
1886	30.43	16.84	14.43
1887	24.60	18.98	21.64
1888	21.17	13.80	20.31
1889	28.11	16.46	18.75
1890	13.43	12.00	15.81
1891	33.32	23.75	24.73
1892	22.43	19.72	27.89
1893	15.67	10.28	14.38
1894	10.33	11.30	12.54
1895	20.14	11.18	15.28
1896	24.35	17.31	19.48
1897	24.94	19.52	19.10
1898	22.23	16.65	15.57
1899	16.76	13.42	16.25
1900	18.56	14.90	19.61
1901	20.34	16.70	22.53
1902	28.05	21.27	19.17
1903	25.50	14.36	19.88
1904	22.89	15.92	18.19
1905	33.30	24.81	25.52
1906	23,51	23.81	23.48
Mean	23.73	17.60	18.85

Upon two occasions the whole southwestern section has had 10 inches or less of rainfall, while it has also had over 33 inches four different years out of the last thirty. In the western section they have had only 10 to 14 inches of rainfall eight years out of thirty, while they have had as high as 30 inches one year and 22 or more seven years out of the thirty. The figures for the northwestern section are similar. There is much evidence to indicate that with about 22 inches of rainfall they are reasonably sure of a crop with almost any kind of farming in the western portion of the State. On that basis the southwestern section of the State would raise a crop about half of the time, while the western section would raise a crop seven years out of thirty, or about one crop in four years.

Perhaps a better idea of the variability of rainfall may be obtained by examining particular points, as it is not always fair to take the average rainfall for a large region in the West. Rainfall is very apt to be local, especially in western Kansas and Nebraska. This is brought out in Table II, where we have tabulated the rainfall for three different localities in western Nebraska—Culbertson in the southwestern part, Sidney and Kimball in the western part, and Fort Robinson in the northwestern part.

TABLE II.—*Rainfall at three points in western Nebraska, 1884 to 1905.*

Year.	Culbertson.	Sidney and Kimball.	Fort Robinson.
	Inches.	*Inches.*	*Inches.*
1884	....	....	13.9
1885	....	....	19.0
1886	....	7.7	11.0
1887	....	17.4	25.2
1888	....	10.9	17.5
1889	20.6	14.6	13.9
1890	13.9	12.1	11.7
1891	30.6	18.4	18.7
1892	23.0	21.4	32.3
1893	....	8.6	10.8
1894	6.8	....	14.4
1895	19.8	11.1	14.6
1896	18.4	....	12.6
1897	28.9	20.9	10.4
1898	19.7	18.0	14.1
1899	17.7	12.2	14.3
1900	15.4	14.9	19.6
1901	16.8	17.5	19.8
1902	23.8	17.3	19.5
1903	20.7	13.6	16.8
1904	20.0	13.2	13.9
1905	26.1	25.5	....
Average	20.0	15.3	16.49

Culbertson.—Average for sixteen years, 20.01 inches; five years, over 23 inches; eleven years, over 18 inches; three years, 15 inches or less.

Sidney and Kimball.—Average for eighteen years, 15.3 inches; three years, over 20 inches; five years, over 18 inches; four years, 11 inches or less.

Fort Robinson.—Average for twenty-two years, 16.49 inches; two years, over 25 inches; seven years, over 18 inches; four years, 11 inches or less.

At Fort Robinson, with an average rainfall of 16.49 inches, which is almost below the minimum for crop production, they have had over 25 inches for two years out of the past twenty-two, and over 18 inches seven years out of the twenty-two, while they have had 11 inches of rain or less four years. There is no exact correlation between rainfall and crop production in this region, as hot winds or insects may easily destroy the crop even with plenty of rainfall. However, we know that a number of very good crops have been raised in that region, as much as 30 bushels of wheat and 60 or 70 bushels of oats within the last few years, and there seems to be evidence that with 18 or 20 inches of rainfall in this region the farmers are reasonably sure of a good crop. On that basis we might assume that at Fort Robinson they have had seven crops in the last twenty-two years, a light crop a number of other years, and a few complete failures. At Sidney they have had sufficient rainfall for a crop three or four years out of the past eighteen and a number of failures, while at Culbertson it would seem that they have had sufficient rainfall for a crop probably half the time. Table III illustrates in a more graphic way the variability of rainfall in this region, both for the crop season and for the year.

TABLE III.—*Variability of rainfall at points in Nebraska, Minnesota, Iowa, and Missouri.*

Locality.	Crop season (April to August, inclusive).			For the year.	
	Normal rainfall.	Variability.		Normal rainfall.	Variability.
	Inches.	*Inches.*	*Per cent.*	*Inches.*	*Per cent.*
Fort Robinson, Nebr	10.88	4.47	41	16.49	23
Kimball, Nebr	10.96	4.66	43	15.50	33
Culbertson, Nebr	14.37	6.86	48	20.70	21
Lincoln, Nebr			48	27.95	24
St. Paul, Minn					13
Davenport, Iowa					16
St. Louis, Mo					14

The variability of rainfall during the crop season is from 41 per cent to 48 per cent at the three points first mentioned, while it is 21 per cent to 33 per cent for the year. It will also be seen that the per cent of variability is 48 at Lincoln. However, the annual rainfall is 28 inches at Lincoln and 15½ inches at Kimball, and a variability of 40 per cent makes a greater difference where the normal rainfall is really below the minimum necessary for crop production than where the rainfall is considerably above the minimum. For comparison, the variability of rainfall at several other well-known points is also given. The great uncertainty of crop production in this region has resulted in a type of farming somewhat peculiar to the West and in some ways rather a practical adaptation to the conditions. The people of this region are not shiftless, but are both practical and optimistic and deserve some credit for their ability to adapt their methods of cultivation to a climate of this nature and be able to succeed as well as they do. The principle in most of the farming seems to be to put as little expense as possible into the farming of an acre of ground, on the theory that if rains come a good crop will be produced and if rains do not come nothing will be produced under any conditions. This enables them to farm more extensively and to cultivate the land at one-third to one-half as much expense as in eastern Nebraska; hence, if they secure a crop one-half or one-third of the time it is produced almost as cheaply as a crop in eastern Nebraska. Their cheaper cultivation is due partly to the fact that weeds are less troublesome and partly to the fact that, owing to the drier seasons, the soil is kept in good tilth much easier. However, this should not be too encouraging, as there are many disadvantages connected with securing a crop only once in two or three years even though it may be produced as cheaply as a crop every year. However, it is this question of comparative cost of production under different conditions and with different systems of farming that really tests the merits of the case. The western farmers are now practicing an extensive system of farming, but a good deal is being said about the use of an intensive system of most extreme type. Just how far we shall proceed toward the intensive system must be determined solely on the comparative cost of production between the extensive and intensive systems of farming under western conditions.

In regard to the present cost of producing crops in the more humid and in the drier portions of the State it is not easy to secure reliable statistics. Table IV shows that for a period of eleven years, from 1889 to 1899, inclusive, it cost the Standard Cattle Company, at Ames, Nebr., an average of 19 cents a bushel to produce corn on an annual area of about 2,000 acres.

Table IV.—*Cost of producing corn at Ames, in eastern Nebraska, 1889–1899.*

Year.	Total acreage.	Yield per acre.	Total cost.	Cost per acre.	Cost per bushel.
	Acres.	*Bushels.*			*Cents.*
1889	1,485	27.0	$4,867.42	$3.28	12.2
1890	1,485	22.5	8,924.79	6.01	26.7
1891	1,825	23.0	9,154.20	5.01	22.0
1892	1,825	28.0	9,499.97	5.20	18.5
1893	1,325	45.3	9,198.80	6.93	15.3
1894	1,792	22.8	11,950.83	6.66	29.1
1895	1,875	40.6	14,181.48	7.56	18.6
1896	2,462	68.6	19,888.70	8.08	11.7
1897	2,717	41.1	17,772.85	6.54	15.9
1898	3,431	31.5	21,575.89	6.32	20.1
1899	1,644	35.9	12,015.80	7.53	20.0
Average	1,987	35.1	12,639.80	6.28	19.1

The average cost per acre was $6.28. However, the annual cost per acre varied from $3.28 to $8.08, and it will be noticed that the cheapest corn was produced the year when it cost most per acre, and the next cheapest corn when it cost the least per acre. Since these data were taken, the rent of the land and the price of labor have advanced from 25 to 50 per cent, so that corn in the same region at present would probably cost 23 cents or 24 cents per bushel to produce.

A few years ago Mr. Coburn collected data from fifty-four counties in eastern Kansas on the cost of producing corn. He showed that the average cost of corn for the ten years previous was 20½ cents a bushel. However, the rent of the land and the cost of labor have also gone up in Kansas about the same as in Nebraska, so that, if data were collected now, they would probably show that corn in Kansas is costing 23 or 24 cents. In Table V I have attempted to compile a few data showing the average cost of production of crops in Kansas and Nebraska. The first part of the table is compiled from Mr. Coburn's reports for the years 1897 to 1906, inclusive. Nine counties were selected in northeastern Kansas and nine counties in northwestern Kansas.

TABLE V.—*Cost of producing corn in Kansas and Nebraska, 1897–1906, inclusive.*

AVERAGE IN KANSAS.

	Northeastern Kansas.		Northwestern Kansas.	
	Corn.	Winter wheat.	Corn.	Winter wheat.
Yield per acre, bushels	26.3	16.6	13.5	9.77
Value per acre	$8.92	$10.82	$4.52	$5.68
Value per bushel	$0.336	$0.649	$0.356	$0.573
Cost per acre [a]	$6.60	$7.35	$3.00	$4.35
Cost per bushel [a]	$0.25	$0.44	$0.22	$0.45

[a] Estimated.

AVERAGE IN NEBRASKA.

	Eastern Nebraska.		Western Nebraska.	
	Corn.	Winter wheat.	Corn.	Winter wheat.
Yield per acre, bushels	33	18	15	10
Cost per acre	$6.60	$7.35	$3.00	$4.35
Cost per bushel	$0.20	$0.40	$0.20	$0.43

AVERAGE FOR KANSAS AND NEBRASKA.

Cost per bushel	$0.225	$0.42	$0.21	$0.44

From these tables it will be seen that the average yield of corn in northeastern Kansas in ten years has been 26.3 bushels per acre, and for the nine counties in northwestern Kansas, 13.5 bushels, practically one-half as much. The average price per bushel in western Kansas has been about 2 cents more, and the average value per acre about one-half as much. I have made a careful estimate of the cost of producing corn in eastern and western Nebraska, and assuming that it costs about the same in Kansas I use this to get the average cost of production in eastern and western Kansas. My figure for producing corn in eastern Nebraska is $6.60, counting rent at $3 per acre; labor of a man, $1 per day; of man, team, and tools, $3 per day.

A few years ago Mr. Coburn made an estimate of $5.73 as the cost of production in eastern Kansas, but as rent of land and labor were cheaper it is certainly more than that to-day. In western Nebraska I have estimated the cost of production at about $3 per acre. This difference in cost is due largely to the fact that they list more and plow much less, that the rent of land is about $1.50 cheaper per acre, and that fewer cultivations are necessary to destroy the weeds. Large tools are also used, and the ground worked more rapidly. I believe that $3 per acre is a fair estimate. On this basis corn in eastern Kansas for the past ten years has cost 25 cents a bushel and corn in western Kansas 22 cents.

Winter wheat has averaged 15.6 bushels for eastern Kansas and 9.77 bushels for western Kansas, about three-fifths as much for the west as for the east. I have again used my Nebraska estimates for the cost of production of wheat in eastern and western Nebraska. According to this estimate wheat has cost 44 cents per bushel in eastern Kansas and 45 cents in western Kansas. In obtaining the yield per acre my source of statistics has not been as extensive for Nebraska as for Kansas, but I have made as close an estimate as possible from the data at hand. According to these I would place the cost of producing corn at 20 cents for eastern and western Nebraska and wheat at 40 cents for eastern Nebraska and 42 cents for western. I think there probably is no real difference in cost per bushel between Kansas and Nebraska, but I am using the best statistics I can secure.

If my figures are at all reliable they show that at present, at least for the period of the last ten years, corn and wheat have been produced about as cheaply per bushel in western Kansas and Nebraska as they have in the eastern part of those States. From this it would seem that at least until the rent of land increases they are doing fairly good farming in the western sections. It must not be concluded, however, that because they raise grain as cheaply by the bushel their farming is as profitable, because there are many disadvantages with raising crops only a part of the time as compared with raising crops every year. For comparison, I desired to obtain some data in regard to cost of production under more intensive farming in the western areas, but was unable to find such data. It is to be regretted that some such data are not at hand, for upon the cost of production will depend the development of the intensive system of farming.

It must be remembered that the merits of a system of farming are not determined by what some one can figure out ought to be made by it, or even by what some expert is able to accomplish. For example, anyone ought to be able to figure out with the stub end of a lead pencil that farmers in eastern Nebraska should raise corn at 15 cents per bushel, and a few farmers are doing this, but it does not prove that the average farmer has the ability to do this. In the same way, while some of the intensive systems of dry-land farming seem all right in theory, we can not judge of their merits until thoroughly tried in the hands of farmers. The value of the system depends on what the farmers as a class may be able to do with it. No matter how good the system may be in theory or in the hands of an expert, if it is too complicated or the principles are too difficult to grasp by the average farmer, the system must be considered impractical.

This emphasizes the importance of collecting accurate data, not only on the cost of producing farm crops under average methods of farm practice but under more intensive systems as well.

BLOWING SOILS.

By L. E. Hazen, *Assistant in Dry-Land Agriculture, Hays Substation, Hays, Kans.*

The long-continued droughts in the semiarid belt are no more of a proposition than the excessive winds. As a rule such crops as wheat, barley, rye, sorghum, cowpeas, and Kafir corn will withstand a drought of six weeks to two months fairly well if there is no wind. Alfalfa will grow on 11 per cent of water in the first 3 feet, retaining a rich green color; two hours of 40-mile wind will stop all growth and cause a yellow tinge to appear on the leaves with 18 to 20 per cent of water in the soil and an air temperature of not over 80° F.

There has been much written to explain how to establish a soil mulch, but so far there is little information as to how to keep it. A dust mulch will check evaporation, but the first stiff wind will blow the mulch away. Because this fact is overlooked land is being sold in western Kansas and eastern Colorado for $10 an acre which is really not worth $5. The clean-cultivated land at Hays blows very badly each spring, as the records show; land which is lightly tilled does not suffer much.

The following is the cultivation history of the worst-blown land on the reservation this spring:

In November, 1904, the land was plowed and harrowed; in March it was again harrowed and was planted to spring crops—wheat, oats, and barley. The part of the field west of the road was disked and harrowed in mid-April, plowed in July, and harrowed but not packed, as heavy rain beat it down; August 6 it was harrowed to break the crust and kill weeds; September 30, drilling winter wheat commenced.

In the records the following comments are noted:

> *March 1, 1905.*—During the three days' high winds this whole field blowed badly and considerable wheat is covered because of the flying dirt particles having lodged behind sorghum stalks and in low places. Wheat plants appear rather sickly, though the part in the ground is alive and thrifty.
>
> *April 24, 1906.*—The high wind of to-day did much damage to all spring crops that were above ground, and the barley and spring wheat east of the road were affected most because of the constant drifting of particles from the wheat fields on the west side of the road.

April 26 to 30.—Where wheat is killed the ground is listed to corn.

May 28 to 31.—Cultivated with a 6-disk cultivator. Weather is dry. Cultivation completed June 4.

June 8 to 18.—Second cultivation. A special weeder was used after to conserve moisture; completed weeding 20th.

June 27 to July 3.—Cultivated the third time.

July 25.—Used spiked plank.

July 27.—Rain stopped this work.

August 4.—Commenced using one-horse cultivator between rows to make mulch. Cultivation continued until crop matured.

March 8 to 10, 1907.—Stalks raked and burned and disking commenced.

February 18 to 20.—In another part of this flat the fall-plowed land was gone over with a disk drill having press wheels on to prevent blowing and drifting; wind has been blowing at the rate of 40 miles for a day or two and part of the land has drifted.

It was noted from time to time that rough-harrowed land or that gone over in an east and west direction with a drill did not blow much in a 40-mile wind, but that broken by a special harrow did blow some. To determine the real value of rough harrowing, five 2-foot-square plats were laid off side by side on the hill south of the evaporation tank and the plats were treated as follows: No. 1 was a check plat, its surface being entirely free from vegetation, but no cultivation was given. No. 2 was rough-harrowed east and west, but was not stirred enough to make the dirt fine. No. 3 was also rough-harrowed, but the cultivation was so frequent that it had a very fine mulch. No. 4 had a broken crust of the same quality as No. 2, but was laid smooth instead of in ridges. No. 5 had a very fine, level, mulch surface.

In a 30-mile wind no blowing of any consequence took place, although plat No. 5 showed signs of losing dust; in a 35-mile wind Nos. 4 and 5 both blew some. In a 40-mile wind Nos. 3, 4, and 5 blew, and the mulch from No. 5 had to be reestablished. No difference in rate of blowing could be detected between Nos. 4 and 5 until the wind dropped to 30 or 35 miles, when No. 5 alone lost dirt. In a 50-mile wind No. 2 showed signs of blowing, as did the check plat; in a 57-mile wind all four cultivated surfaces blew away, but the check plat blew very little. The conclusion arrived at is that rough harrowing has no great advantage in a high wind.

The Department of Horticulture has a small timber strip which surpasses anything for blowing the writer ever saw. It runs north and south along the fence next to the highway. This field grew barley in 1904, and about the middle of September it was plowed and harrowed. A number of lister rows were opened, tree seeds being dropped and covered with a cultivator. The field was again cultivated in April, and then was kept continually loose with hoe, disk, cultivator, a tooth and slicing harrow, and throughout the season had a heavy dust mulch. The dust blew from this in clouds and drifted so thickly in the yard west of the boarding house as to kill weeds and grass in places.

An orchard plowed and harrowed this spring, then planted and intertilled, has not suffered from blowing as yet. The main tillage is east and west. This field was a big weed patch last year.

Trees do not start readily at Hays, but cottonwood and honey locust do fairly well, and where trees protect the south side of a field there is little blowing until a point is reached several rods from the protecting belt. Frequent timber belts running east and west, plenty of sod-forming crops, and care not to leave a smooth, fine-grained surface seem at present to be the best checks to this trouble.

PLANT BREEDING IN CONJUNCTION WITH DRY-LAND AGRICULTURE.

By L. R. Waldron, *Superintendent Agricultural Substation, Dickinson, N. Dak.*

While the variety testing, plant selection, and plant breeding carried on at the various experiment stations connected with the semiarid belt can not fail to be of much benefit to our cooperative work, yet the ground may not be entirely covered and valuable work may be undertaken at the substations in immediate connection with the different cooperative projects. Any work of this character must be undertaken seriously, be well planned in advance, and funds must be set aside to carry it out. Obviously the work should be of as simple a nature as is consistent with the results to be obtained. Simple and well-tried methods applied along new lines may produce as satisfactory results as though more modern theories were used with a less sure hand.

In the past plant breeding, or perhaps more properly plant selection, has been devoted mainly to an increase of yield, an increase of rust resistance, of drought resistance, of hardiness, of milling quality, etc., and while these qualities are desirable and even necessary in our work, it may be that there are other qualities of equal value to be developed in grains which are to become preeminently suitable for our dry areas. Or may it not be possible that some of the qualities mentioned are really complexes which by appropriate methods may be analyzed into simpler elements? The terms vigor and hardiness may mean much or little, depending on the user's standpoint. We are learning that the term "drought resistance" has an increasingly wider meaning, subjectively; and until we know the methods by which the plant may overcome lack of moisture we may hope to make but little progress by selecting along this line.

What are some of the difficulties against which cereals have to contend in the area which interests us? Surely one of the difficulties, though not the chief, is the cold soil which the spring-sown grains find ready to receive them. At Dickinson this season some grain scattered from the thrasher germinated in March and maintained a successful growth until the first of June, when it was pastured, being far in advance of grain sown in early April, which did not appear above ground until the first week of May. This great difference was evidently due almost wholly to the warmer substratum secured to the early germinating grain. Now, while it may be difficult to move the mountain Mahometward by warming the soil, it may be possible to dislodge Mahomet by modifying our grain. At any rate the idea is worth thinking about, and perhaps acting upon.

In a variety of grain is it not possible that there are some kernels which will start at a lower temperature than other kernels? From the writer's observation upon grain sprouted in a germinator at a rather low temperature it seems very probable that this is so. Proceeding on this assumption, it would seem but a simple matter to run the germinator at a temperature just below the degree necessary to cause germination for that particular variety, and from several thousand grains there may be one hundred which start at this lower temperature. These could be transplanted to the open ground and selection could then be made for yield and other qualities. The next year the selected grains could be put through the same or a more exacting germinator test and the work continued as long as desired.

From the writer's observation on the germination of certain weed seeds, it seems reasonable to suppose that the germinating temperature point varies widely with the seed of any one species and that those which germinate at the lower temperature are more frostproof than the remainder. If this should be found to be true of grains, we would be developing not only a strain that germinates at a low temperature, but one that is frost resistant also—a valuable desideratum.

We need not only a grain having the above germinating characters, but one that will germinate with a minimum amount of moisture. The ground at planting time in the semiarid regions is apt to contain less than the optimum water content for germination. A grain that would accommodate itself to the drier conditions would aid the farmer in making good in his struggle for maintenance. It would seem feasible to fit up a germinator having the moisture content under control. In such a germinator, having the moisture content just below the minimum for germination, there could be selected grains or seedlings requiring the minimum amount of moisture. Such seedlings could then be planted out.

These ideas could be carried out in a limited manner by purely out-of-door methods, but the work would be under better control and results would be attained more rapidly if the most essential portion of the work were carried on inside. Perhaps a method more suitable than that of the seed germinator would be that of a small glasshouse the temperature of which could be controlled. In such a place the plants could be started at the minimum temperature and later transplanted. In other beds, with the moisture content kept at certain percentages, seeds could be sown and the desired seedlings could be transplanted and treated as seemed best. In carrying out the above suggestions the idea of using the various methods in combination readily comes to mind.

While the difficulties attending plant selection carried on along the lines indicated are of some importance, yet it is believed that they are not insuperable, even to the substations. Furthermore, the beneficial results accruing should prove of much importance, not only as an end in themselves, but for the light that would be thrown upon other problems now scarcely guessed at.

RATE OF SOWING DURUM WHEAT.

By L. R. Waldron, *Superintendent, Agricultural Substation, Dickinson, N. Dak.*[a]

The statement is often made, by scientists as well as by farmers, that in sowing durum wheats the drill should be set to sow more than if sowing Fife or Bluestem wheats. This statement seems to be based on three assumptions: (1) That the grains, being larger, feed more slowly through the drill; (2) that the grains, being larger, a greater volume per acre is needed in order that as many grains per acre be sown as of the common wheats; (3) that as the durums stool less, they need to be sown more thickly in order that as many heads per given area may be produced as in the case of the common wheats. These postulates overlap somewhat and can not all be used in the same argument.

Recently the author has made a little study with a view to testing the soundness of the practices derived from the above conclusions and also of the conclusions themselves. Two varieties of wheat were selected—Kubanka and Rysting's Fife. The Kubanka weighed 63 pounds and the Fife 61 pounds to the bushel. Ten grams of each variety were weighed, and in the durum sample there were found 247 grains, as against 304 grains in the Fife sample. This is an excess of 23 per cent of the Fife grains over durum for a given weight and only a fraction less than 23 per cent for a given volume.

Equal quantities—about 5 pounds each—of the two varieties were weighed out and each sample was placed in one half of a 6-foot drill having but one feed. The drill was set to sow 6 pecks of common wheat. Enough revolutions of the shaft were made to sow one-twentieth of an acre. The wheat that passed through the hose was collected and weighed. It was found that of the Kubanka there were 1,088 grams and of the Fife 1,079 grams that had passed through the drill, a difference of less than 1 per cent, although it was found that the durum grains were 123 per cent the size of the Fife grains. It thus appears that under the conditions given, the two wheats feed at about the same rate. If this holds generally, the first assumption is unfounded.

The second statement is self-evidently true; but is it necessary that more grains, or even as many grains, of the durum be sown per acre as of the Fife in order to produce the best results? It is true that the durums stool less, but is it necessary that they stool so much as the Fifes or Bluestems to produce as much per stool? Are there no other factors entering that tend to offset the deficiency in stooling? In an attempt to answer this question in part, weighings may be given of some stools of these two varieties. They were grown in nursery plats under similar conditions, except that the Fife wheat was sown twelve days later than the durum. Six durum stools and seven Fife stools were selected on the basis of general quality—primarily yield as expressed by stooling. Of the durum, the six stools averaged 4.3 heads to the stool. The shelled grain averaged 10.11 grams per stool. The seven best stools of the Fife averaged 6.8 heads per stool and the shelled grain averaged 6.62 grams per stool. The shelled grain per durum stool thus shows itself to be 52 per cent greater than similar grain from the Fife stools. The durum grain yielded on an average 2.35 grams per head, while the Fife wheat yielded but 0.97 gram per head, an excess of over 140 per cent in favor of the durum. To put the matter more concretely, in order to produce a crop of 30 bushels per acre it would require a stand, according to the figures given, of 16 stools of the Kubanka wheat per square yard, as against 25 stools of the Rysting's Fife. If we were to do any *a priori* reasoning from these figures, the conclusion certainly would not be that the durum wheat needs to be sown the more thickly—rather the reverse. While the data given do not aid us materially in field practice, they serve to brush away certain deductive conclusions and preconceived notions that might prevent a good understanding of the subject. There may be reasons for thicker sowing of the durum, but it is scarcely possible that they lie along the lines indicated at the beginning of this paper.

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[a] Mr. Oliver J. Grace aided in securing some of the data for this paper.

FRUIT GROWING ON THE PLAINS.

By J. E. PAYNE, *Superintendent, Agricultural Substation, Akron, Colo.*

One who has been accustomed to going to the orchard or fruit garden and eating fruit fresh from the trees can hardly imagine that it would be possible to live and raise a family without using fruit of some kind as an article of diet. When fruit is shipped a long distance it is never as good as the fruit which one would select from his own orchard, while the prices which must be paid for the inferior article which the stores occasionally have for sale are prohibitive to the average settler who files on a claim and attempts to eke out an existence for himself and family. So if the children of the Plains country are to have as much fruit as they should have it must be raised at home.

The Plains country is likely to be settled by people who can not get a foothold where land is high priced. They must learn to farm under conditions as they exist. They must find drought-resistant crops for extensive use, and must learn to create suitable conditions for the production of their favorite fruits and vegetables which are not drought resistant. In other words, they must adapt themselves to conditions and learn to create environments suitable for some plants which can not be grown in the community under natural conditions or ordinary methods of culture.

The agriculturists and agronomists are all working and studying to find or produce drought-resistant grains, grasses, and fruits. But I contend that these would avail but little if we could not find "drought-resistant" settlers who are willing to live in the country and demonstrate their value.

I have found that the quality of drought resistance is not confined to the settlers from any State or nation. It seems to be an individual trait instead of a quality of race or country. The man who can adapt himself to the conditions and do the right work at the proper time succeeds in maintaining himself, and those who do not do this fail.

It is argued and has been argued that it does not pay to try to grow fruit and vegetables on the Plains because they can be bought cheaper than they can be raised. But I have noticed that those who talk that way have a very small variety of vegetables on their tables and that they seldom eat fruit of any kind, except the cheapest kind of dried fruit, unless perchance the man happens to be owner of a large ranch from which a few hundred "feeders" are annually sold. Even the wealthiest ranchmen fail to find good fruit and vegetables on the market at all times, and they can supply themselves only by maintaining an orchard and garden for the production of their own supplies of this kind.

Fruit growing, gardening, and forestry as practiced by the ordinary farmer or ranchman are business propositions which it is impossible to demonstrate will pay in dollars and cents for all the work put into them. But as a factor in home building it certainly is easily shown that a good supply of fresh vegetables and fruits is worth all it costs in labor and money, especially when one must either produce his own supply or go without.

Farming as practiced by the majority of men owning the land which they use is a home-building proposition instead of a business venture. Some men I have known whose annual production would not average $500 cash market value per year have lived on the Plains and raised large families. As wages for a man and his wife and children, all working hard, this does not seem like a business proposition. But the same man, if placed in some factory, would have to earn all the income, and he would not earn any more than the family earns on the drought-stricken prairie. If the father was employed in a factory the children would miss the sturdy training in thrift and industry that helping with the stock and doing farm work give. So, while at first the settler may appear to be playing a losing game, when we consider ultimate aims he has probably done more for his family and for society at large by raising a few honest, industrious men and women, who will also be "drought resistant," than he could do in any other way, and they will be able to give efficient aid in conquéring the remainder of the American desert.

Introduced trees and shrubs which have been tested have often given results not on account of drought-resistant qualities but because their fruit grew and ripened during the part of the year when humid conditions existed.

Cherries, plums, and gooseberries have usually produced well. Only standard varieties of these have been tested by the writer, and it is his belief that they have succeeded because they make their growth of fruit before July 1, or before the usual time of drought. The Russian mulberry can also be depended upon to produce considerable fruit, which gives much pleasure to birds and children, and several varieties produced fruit at Cheyenne Wells. The sand cherry and the wild black currant are found native in many parts of the Plains area. These also grow their fruit mainly during the humid parts of the year. Apples have not been successfully grown without irrigation, except during periods of excessive rainfall. Apple trees have been grown in many places on the Plains by careful tillage, but nearly every year there is a time when the fruit is injured by drought. If the owner is prepared to give the trees a good irrigation at these critical times, they will produce good fruit. Otherwise much of the fruit falls and that which remains does not ripen properly, but withers and never has a good flavor.

As water is necessary for trees or gardens, these should be located where it will be possible to give the trees extra water in some way and also guard against an accumulation of excess water about their roots in times of heavy rainfall. The ideal location for an orchard is on a slope adjoining permanent pasture land, where the storm water may be carried to ditches made just above the rows of trees and distributed automatically during the storm, each tree to have a hole just above it on the slope, which will be filled from the prairie flood water. This method is shown in the map of James Howell's orchard, which is situated near Flagler, Colo. (See fig. 1.) The mistake of not providing for drainage is shown in the same orchard. The trees planted in the creek bed below the dam were much damaged by extra water during a season of excessive rainfall. During dry years they did well, but when a series of years having abnormal rainfall came many trees planted in the old creek bed died.

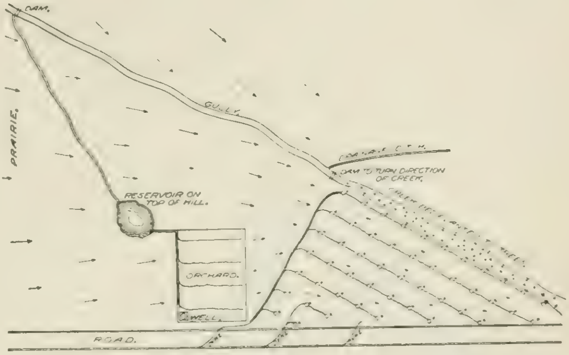

FIG. 1.—Diagram of James Howell's orchard, Flagler, Colo.

Having chosen the location, the next thing to consider is the preparation of the land. Two extreme methods have been practiced, both with fair success. One is merely to dig holes for the trees and set them in the sod; the other is to plow the land several times during one year, each time a little deeper, and again in the spring just before planting. At this last plowing the tract is plowed in narrow lands, so that each row of trees will be planted in a dead furrow. Holes are dug and the trees set carefully with roots naturally spread. The top soil should be thrown in first and carefully packed. Trees should not be set when the ground is wet. The trees should be set and covered a little deeper than they were in the nursery row. The holes should be deep enough to be left with about 6 inches unfilled. This, with the furrow in which the holes were dug, will make a reservoir for holding storm water until it can sink into the ground. The trees planted should be trimmed so as to balance the root system and the top. Cut off all bruised roots and limbs and leave the limbs which are in position to make each tree well balanced. Pruning in after years will be likely confined to cutting out interfering branches. Each year more wood will be cut out, until after a few years a wagon load of brush will be cut from an acre of apple trees each year. Pruning should be done just before the growth starts in the spring, so that the wounds will quickly heal before they are exposed to dry, cold winds.

The orchard should be cultivated carefully, so as to keep the weeds down and preserve a soil mulch. The disk harrow is probably the best tool we have for maintaining a deep soil mulch. The smoothing harrow used with teeth set slanting forward is good for maintaining a moderately deep mulch. I have always begun cultivation early in March and stopped by August 15. Some years the orchard was not cultivated after July 31. Frequency of cultivation depended upon rainfall. The tool used for any cultivation also depended upon the condition of the ground. I never tried a cover crop, as I had the care of one orchard only eight years, and it grew well under clean culture and was not large enough to make any tests which would have been of any value.

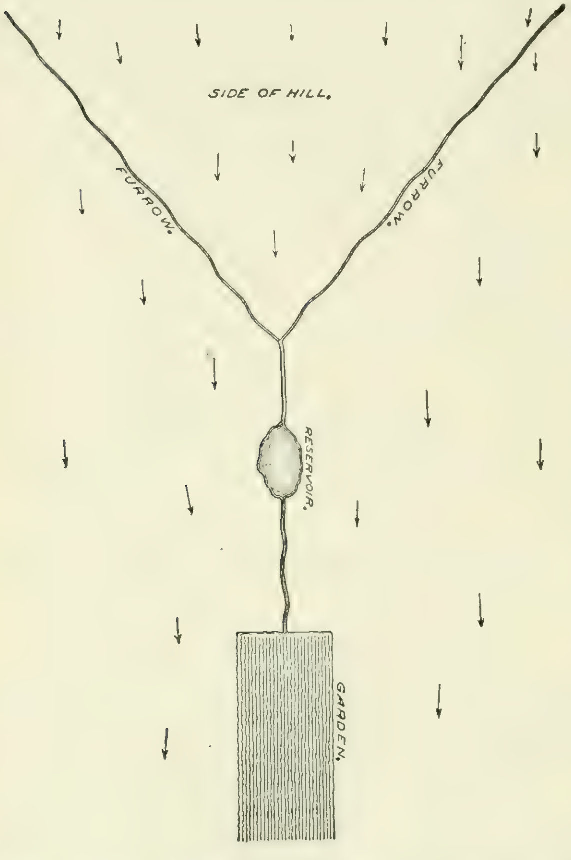

FIG. 2.—Diagram showing simple method of utilizing storm waters.

The fruit garden should not be extensive, but should include enough trees of each kind to furnish a succession during the summer and an abundant supply for winter use. It should be surrounded by a windbreak of hardy trees. I would now plant three rows of hardy trees 8 feet apart each way if I were planning a garden. I would use Russian mulberry, black locust, and wild Russian olive for making the shelter belt. The black locust and wild olive are ornamental trees, and the Russian mulberry bears fruit which is quite acceptable to the bird friends and children.

The work done in testing fruit trees has been pioneer work only. It has been demonstrated that fruit trees will grow in the Plains country if cared for properly. Variety tests should follow. We have produced good crops of Weaver, Minor, and Wolf plums; also good crops of Early Richmond, Early May, and English Morello cherries. The Downing gooseberry has done well. Apples of standard sorts, as Ben Davis, Missouri Pippin, Winesap, and Duchess of Oldenburg have all thrived and have borne a few good crops. Peaches have often winterkilled, so if any of them are raised hardy sorts must be imported or the trees must be covered during the winter. Apricots make beautiful trees, but they nearly always blossom too soon in the spring to produce a crop of fruit. Standard grape varieties, such as Concord and Delaware, produce vegetative growth, but seldom fruit.

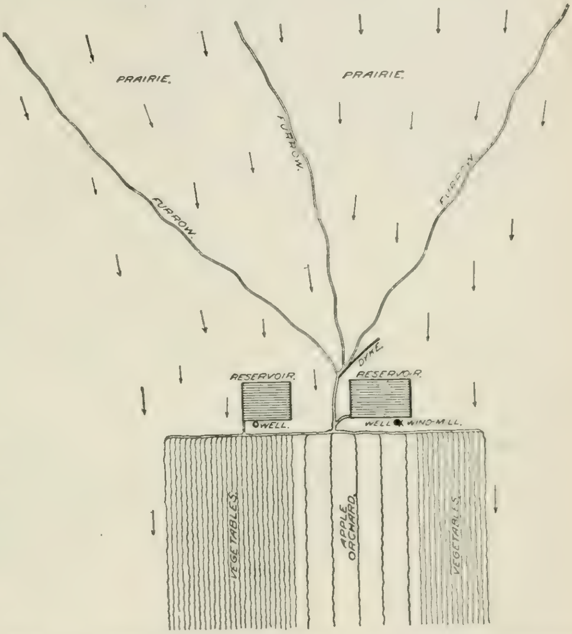

FIG. 3.—Diagram showing combination of windmill irrigation and utilization of storm waters near Akron, Colo.

After protection from the storms, the most important consideration in the production of fruit is a certain water supply in time of need. Some try to store this in the soil by cultivation, and when storm water can be drained from other land onto the fruit garden this method is a success. But during dry years trees suffer if they get only the water that can be saved from the rain which falls upon the space occupied by the orchard.

Another method is by irrigating from wells. Some use a combination of these two methods.

In the accompanying illustrations are shown some methods of getting extra water for the fruit garden. Figure 2 shows a simple method of catching the water from a hillside and storing it in a buffalo wallow situated above the garden. This reservoir is fed by a deep-trodden cattle path. It holds water for several days and this is put upon the garden where it is most needed.

Figure 1 shows a more complicated system involving the same general plan and used in combination with a well, so that if the storm water does not come at the right time the trees may be watered from the well. This garden is located near Flagler, Colo. The reservoir on the hill is fed from the prairie by throwing a dam across the head of an arroyo or gully and making a ditch from above the dam to the reservoir. The same arroyo is dammed lower down and turned out of its course, leaving the old channel dry but subirrigated from the pond above the dam. Trees were planted in the old channel, but the wet years of 1904 and 1905 caused them to be much damaged by too much water standing about their roots and many of them died. During the dry years these trees did well. The trees planted upon the slope get the storm water from the higher land and the holes above the trees on the slope are often filled. This extra water, combined with good cultivation, has kept the trees on the slope in good condition and able to bear fruit every year, although the crop is sometimes destroyed by hail. This fruit garden was set out about fifteen years ago and drought has caused no failures there.

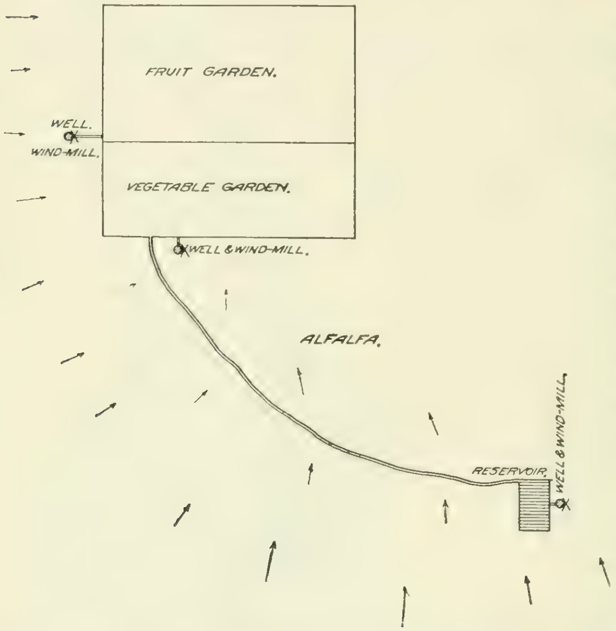

FIG. 4.—Diagram showing windmill irrigation as practiced by John Rose, Seibert, Colo.

Figure 3 shows another combination of the use of storm water, with windmill irrigation. This is a commercial fruit and vegetable garden. It is located near Akron, Colo., and the owner has supplied the community with vegetables and small fruit for several years. The storm water is used to water the trees and large crops, while the water from the wells is stored and used for watering vegetables. This garden has furnished an income of about $800 a year, besides the ice crop from the reservoir, which often amounts to $500 a year.

Figure 4 shows a type of windmill irrigation plant of which there are many on the Plains. The one chosen belongs to a pioneer in this line, Mr. John Rose, who is located near Seibert, Colo. Mr. Rose began with one well and no mill. Later a mill was obtained, but blew down, and until it was put up again, several weeks later, Mrs. Rose pumped water by hand five hours every day in order to save her strawberries and trees. This garden was only a few square rods in extent at first, but it was extended as experience dictated until now three wells water about three acres. Mrs. Rose says that the little fruit garden enabled the family to live when they would have been compelled to leave if their garden had not been a success. Many of their neighbors sneered at the "little patch" at first, but now, after eighteen years of demonstration, every settler within 10 miles of Mr. Rose has a small fruit garden, and they have nearly all obtained strawberry plants from that pioneer fruit farmer.

There is no doubt that every man can have a fruit garden if he is willing to make sacrifices to start it and care for it; but he must remember to make conditions to suit the plants, instead of trying to change the plants to drought-resistant varieties.

OKLAHOMA ROTATIONS AND THEIR RELATION TO SOIL-CULTURE WORK.

By L. A. Moorhouse, *Agronomist, Oklahoma Agricultural Experiment Station, Stillwater, Okla.*

Rotation of crops in agriculture and horticulture has been defined as the system or practice of growing a recurring series of different annual crops upon the same piece of land. The system is based on the fact that various crops not only require but absorb different quantities of the mineral constituents of the soil; hence, if one crop is grown continuously upon the same section of land for a period of years and one of the essential elements is drawn upon to an excessive degree, it is evident that unless the supply of this constituent is present in unlimited quantities, the plant food elements will be thrown out of balance and low crop yields will result. Sir Henry Gilbert, in presenting a review of the rotation experiments at the Rothamsted station, gives us the following definition:

> If I had to define the practice of rotation of crops as followed in our own country (England)—indeed, over large portions of Europe—in the fewest possible words, I should say that it consists in the alternation of root crops and of leguminous crops with cereals. In the United States, however, it is a gramineous crop (maize) which largely takes the place of the root crops in Europe.

The same writer also makes the following observations:

> The cereals constituting such a very important element of human food, it was natural that they should be grown almost continuously so long as the land would yield remunerative crops. Hence, the history of agriculture, not only in our own country but in others where these crops were of high relative value, shows that it very generally came to be the custom to grow them for a number of years in succession and then to have recourse to bare fallow, or in some cases to abandon the land to the growth of rough and weedy herbage, affording scanty food for domestic animals.

This is precisely the history of agriculture in this country. First, the one-crop system constitutes the sole arrangement for the farm; then a reduction in yield necessitates some modification, and we note that an abandoned farm is the final outcome. History must not repeat itself in the West. With all our modern ideas in the realm of chemistry, with new light in the field of biology, and with a mass of experimental data from the physical laboratory, where the soil is carefully studied, the problems which are confronting the agriculturist of the West should not go unsolved. It is my belief that we are coming to a plane where more substantial experimental work can be planned and carried into effect, but this fact should not lead us to relax our efforts or to conclude that the goal has been reached, for it appears to me that we are merely commencing to grasp first principles.

Several reasons may be advanced in favor of a well-planned rotation. In the first place, the adoption of such a system will enable the husbandman to distribute the farm labor throughout the greater part of the year; thus men who were formerly engaged for short periods will be given continuous employment. Again, a variety of crops, marketed at different periods of the year, gives a steady and regular income to the farmer, and, as a matter of fact, he will be able to manipulate his affairs with a smaller capital. Success in commercial life depends to a great extent on the business management, and this is also true in regard to agricultural pursuits. A good rotation affords an opportunity for making regular applications of farm manure on the respective areas; hence, the fertility of the soil will not deteriorate as rapidly as under the one-crop system, where manure is added sparingly; moreover, clean-culture crops can alternate with uncultivated crops and weeds may be held in check quite effectively. These and other reasons which might be given are decidedly in favor of a definite system in the order of cropping.

One of the first questions which comes to us in making suggestions for the farmers of the West is this: "What factors should be observed in planning a rotation?" This question can not be answered for us from the standpoint of the eastern farmer, although the latter might receive instruction by observing western methods, and we can undoubtedly profit by investigating his plans. It is possible that some of our failures in the semiarid region have been due largely to a strict adherence to some local ideas which have been imbibed under entirely different surroundings. The newcomer must learn to adapt himself to new conditions, and in order to do this successfully a study of the past history of this great area will be imperative. The conservation of soil moisture is an important item; thus, if maximum returns are to be secured, this factor must be reckoned with in the arrangement of our rotation.

In discussing these factors it will be necessary for me to confine my attention to data which have been collected during the past ten years at the Oklahoma Agricultural Experiment Station. The rainfall for this point is much higher than the rainfall which is reported for western parts of the territory; however, if any general deductions can be made in a study of our records for this county, a few of these lessons may be applicable under western conditions.

In the first place, let us consider the precipitation throughout a period of years, and perchance we may determine the relation between the rainfall and our crop systems. Our records are complete for the years 1896 to 1906, inclusive; and the monthly distribution for this period is given for two five-year periods. The average for the first five years—1896–1900—is given in Table I, while the average for the second period—1901–1905—is given in Table II. The latter table also contains a ten-year average. The report blanks from which these figures were taken were apparently incomplete for the years 1893 to 1895, inclusive, consequently it would hardly be correct to make any comment for this period.

Table I.—*Precipitation at the Oklahoma Agricultural Experiment Station for 1896 to 1900, inclusive.*

Month.	1896.	1897.	1898.	1899.	1900.	Average, 5 years.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	0.55	0.76	3.53	0.48	0.23	1.11
February	.19	1.51	3.00	.47	.79	1.19
March	1.21	3.51	2.75	1.03	.51	1.80
April	.94	6.36	.58	4.97	4.43	3.46
May	5.93	4.77	8.56	5.61	3.71	5.72
June	7.26	4.13	4.72	3.64	3.28	4.61
July	5.85	2.63	6.35	4.54	2.69	4.41
August	1.64	4.51	2.86	2.57	1.39	2.59
September	2.54	.71	2.72	.88	9.22	3.21
October	2.88	97	4.19	5.15	2.87	3.21
November	1.56	.80	.68	1.93	.65	1.12
December	.85	.87	2.68	1.60	.21	1.24
Year	31.40	31.53	42.62	32.87	29.98	33.68

The snowfall for this five-year period was not excessive, and yet there was sufficient to furnish at times a fair supply of moisture for the soil. It should be noted that almost the entire quantity of water falling in the form of snow eventually passes into the soil, because the time required to melt the snow generally exceeds one or two days, and if the material is not carried from the field by high winds some addition is made to the capillary water of the surface and subsurface area. The distribution for the period was as follows: January, 1896, 0.08 inch; January, 1897, 0.05 inch; December, 1897, 0.49 inch; December, 1898, 1.25 inches; January, 1899, 2.5 inches; February, 1899, 0.5 inch; March, 1899, 1.9 inches; December, 1899, 4.5 inches; January, 1900, 0.12 inch; February, 1900, 1.2 inches. The maximum snowfall for this period occurred in December, 1899. It should be observed that this precipitation was timely, inasmuch as the rainfall for the three subsequent months did not exceed 1.52 inches. In making a study of the average precipitation for this five-year period two or three facts should be noted. First, our maximum rainfall occurs during the month of May, while the minimum point is reached during the month of January. The average rainfall for November, December, January, and February is comparatively low.

TABLE II.—*Precipitation at the Oklahoma Agricultural Experiment Station for 1901 to 1905, inclusive.*

Month.	1901.	1902.	1903.	1904.	1905.	5-year average.	10-year average.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
January	0.62	0.13	0.25	1.03	1.79	0.76	0.94
February	.59	.17	2.19	.07	1.17	.84	1.02
March	2.95	5.03	3.66	.15	5.42	3.44	2.62
April	1.29	1.92	2.97	.80	2.80	1.96	2.71
May	4.70	10.86	9.27	7.28	4.86	7.39	6.55
June	.79	2.19	.73	6.54	3.76	2.80	3.71
July	1.48	2.85	3.47	5.18	3.19	3.23	3.82
August	1.95	2.17	2.48	7.42	8.15	4.43	3.51
September	1.11	4.64	3.01	1.66	2.38	2.56	2.89
October	2.11	.92	3.52	.13	2.88	1.91	2.56
November	.95	7.78	.55	.21	1.57	2.21	1.67
December	.90	1.63	.48	2.52	.62	1.23	1.24
Year	19.44	40.29	32.58	32.99	38.59	32.78	33.23

The snowfall for this five-year period stands as follows: February, 1901, 1.4 inches; December, 1901, 2 inches; January, 1902, 0.5 inch; December, 1902, 0.9 inch; February, 1903, 1.5 inches; February, 1904, 0.25 inch; November, 1904, 0.05 inch; December, 1904, 0.75 inch; February, 1905, 1.12 inches.

The annual average precipitation for the first five-year period was 33.9 inches, as compared with 32.78 inches for the second period, giving an average for the ten-year period of 33.23 inches. The average monthly precipitation for the years 1896–1900 reaches a maximum point during the month of May, while the lowest rainfall occurred in January. In our second table, which includes the years 1901–1905, the month of May shows the maximum precipitation for the five years, and the lowest point is reached during the same month as in the previous five-year period. The general results in the second period are practically the same as in the first. During the past two years there has been a marked increase in the rainfall for August, and this, with the rainfall for 1906, will have a tendency to raise the average for this part of the season. In general, our average precipitation runs low for the months of November, December, January, and February; then there is a gradual rise to the maximum point in the month of May, and subsequently the averages gradually decline until the end of October.

After making a careful study of these tables I have been led to reach the conclusion that there is a direct relation between the precipitation for this section and the recommendations which have been submitted by our station workers for the guidance of the farmers of the territory. For instance, the fall seeding of alfalfa has usually given more satisfactory results than spring seeding. As a matter of fact, crab-grass (*Panicum sanguinale*) gives less trouble in the fall-sown than in the spring-sown alfalfa, but there is still another reason for the existing preference, and this is found in the fact that the heavy rainfall of the spring months has a decided tendency to wash our fields; hence, many of the young alfalfa plants are destroyed. If the field is plowed early in July and is given good treatment throughout the summer months, the soil will be in excellent condition for seeding the latter part of August or early in September. This plan also facilitates the storage of water within the soil, and the alfalfa plant has a full and continuous supply at hand throughout that period of the year when the rainfall is comparatively light.

Another illustration will serve to make this point somewhat clearer. The station at Stillwater has found that early (July) plowing for wheat gives better returns on the average than late (September) plowing. In this test the ground was plowed on or about July 15, August 15, and September 15 each year, and these plowings were designated "early," "medium," and "late," respectively. Duplicate plats were used in each case. The soil was turned to a depth of 7 to 8 inches and worked down immediately. Subsequently the plats were given light cultivation after each shower or heavy rain. The different areas were all drilled at the same time to Fulcaster wheat at the rate of 1½ bushels per acre. The time of seeding for the five years through which this experiment was carried ranged from September 15 to October 1. The yields are given in Table III.

TABLE III.—*Yields of wheat at Stillwater, Okla., from 1900 to 1904, inclusive, showing the effect of early, medium, and late plowing.*

Year.	Early plowing.		Medium plowing.		Late plowing.	
	Grain.	Straw.	Grain.	Straw.	Grain.	Straw.
	Bush.	*Tons.*	*Bush.*	*Tons.*	*Bush.*	*Tons.*
1900	31.32	1.81	23.48	1.23	15.30	1.00
1901	43.60	1.99	38.20	1.74	40.20	1.92
1902	17.05	.63	18.15	.61	19.35	.81
1903	28.20	1.74	28.50	1.82	27.80	1.73
1904	15.25	.82	12.54	.56	7.51	.34
Average	27.10	1.39	24.20	1.19	22.00	1.15

In five years the early plowed plat produced a total of 135.5 bushels of grain and 6.99 tons of straw per acre; the medium plowing produced 120.7 bushels of grain, with 5.96 tons of straw, and the late plowing produced a total of 110.1 bushels of grain and 5.78 tons of straw. This makes a total difference in five years of 14.8 bushels of grain and 1.03 tons of straw in favor of the early plowing as compared with the medium plowing, and a total difference of 25.4 bushels of grain and 1.21 tons of straw in favor of early plowing as compared with late plowing. These results lead to the conclusions that better yields can be obtained by plowing early in the summer the land which is to be seeded to wheat. This means July 1 to August 15.

The same publication from which these results were copied states:

> It should also be observed that these results were obtained on ground that was given good cultivation after early plowing. Early plowing alone will not suffice. The seed bed must be thoroughly prepared. On a great many farms the plowing is done at an early date, but the fields are allowed to remain in an open, broken condition until a few days before seeding commences, when the surface of the field is given a stroke with the harrow and the grain is drilled immediately. In the interval between the time of plowing and seeding the mechanical condition of the soil has not been improved. The fields become covered with weeds and moisture evaporates rapidly; consequently a poor seed bed and an imperfect germination result.[a]

If we had complete records of the moisture content of these plats during the progress of the experiment we would undoubtedly note an appreciable difference in the percentages shown for the respective treatments, especially during the more unfavorable seasons. If this is true, and we must concede the fact that our experimental data point in this direction, then in planning the rotation for this section some attention should be given to the monthly average precipitation, in order that we may be able to store a full supply of moisture for the growing crop. The different plants in use also consume varying amounts of water; hence, our plan should include a study of the moisture requirements of the crops in question. Our first principle may be resolved into a simple statement which reads thus: (1) The rotation should be so arranged that it will be possible to make the best use of our rainfall; and (2) it should not interfere with the needs of the subsequent crops so far as the moisture is concerned.

We come now to another phase of the subject. The tiller of the soil wishes to maintain the productive capacity of his soil; therefore, the arrangement prescribed must meet the food requirements of the plant if maximum yields are to be maintained. This was the idea which found a prominent position in the minds of those men who were instrumental in giving to the world some well-defined systems. The Norfolk four-course rotation may be mentioned as one of these. Turnips, barley, clover, and wheat were the crops which comprised the list. Coming down to a later date we find that our foremost agricultural investigators have emphasized the importance of maintaining the productive capacity of the soil; hence, they planned their work and made suggestions with this end in view. Permit me to offer another quotation from Sir Henry Gilbert:

> Although different and sometimes very large amounts of these typical mineral constituents are taken up by the various crops constituting the rotation, there is no material export of any in the salable products except of phosphoric acid and potash; and so far, at least, as phosphoric acid is concerned, experience has shown that it may be advantageously supplied in purchased manures.

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[a] Bul. 65, Oklahoma Agricultural Experiment Station, "Wheat Growing."

But although the eventual loss to the land of mineral constituents is in a self-supporting rotation comparatively so small, the very fact that the different crops require for their growth not only very different amounts of individual constituents, but require these to be available within the soil in very different conditions, both of combination and of distribution, points to the conclusion that in any explanation of the benefits of an alternation of crops the position and the rôle of the mineral constituents must not be overlooked, and the less it can be when their connection with the very important element the nitrogen of the crops is considered.

Some agricultural writers of the past have insisted that a well-planned rotation aids in maintaining the fertility of the soil, but they have failed to include the statement that some return in the way of farm manure must be made if large crop yields are to be secured. Perhaps it would not be out of place to make a brief inquiry concerning the removal and ultimate distribution of the essential constituents of plant growth. It has been intimated that a rotation of crops offers a more satisfactory plan for the return of farm manure to the various fields, but the question of making a complete return was not discussed. This leads us to a study of the percentage of the elements which are found in a sample of average manure, and we shall also consider the amount of the mineral constituents which are taken from the soil by our staple crops.

Farm manure is made up of the liquid and solid excrements of the farm stock, together with the litter which has been employed. The term farm manure was formerly used to include all substances which were applied to the land for the purpose of enriching it. "Latterly the meaning of the word has changed somewhat, and it does not now embrace commercial fertilizers or those substances whose chief object is to improve the physical condition of the soil." Farm manure is sometimes called a "general manure," because it contains all the constituents of plant growth and it is likely to be generally useful in all soils. A knowledge of the composition of farm manure is essential to a proper understanding of the principles which have bearing not only upon the preservation of the material, but also in the application of the manure to the land. The composition of manure obtained from different sources varies in a great many cases to quite an extent, but in spite of this fact uniform results have been secured in many laboratories, and a few statements made will be based upon these results.

"Having regard to the more trustworthy of the analyses given in the tables, it will be seen that 100 pounds of good farm manure contains from 70 to 80-odd pounds of water, or say three-quarters of the weight of the whole manure, and it is safe to allow for each 100 pounds of the manure as much as four-tenths to six-tenths of a pound of potash, five-tenths to nine-tenths of a pound of lime, and about two-tenths of a pound of magnesia." In simple form the percentage of the essential elements present in the manure may be stated as follows: Nitrogen, .49 to .69 per cent; phosphorus, .06 to .15 per cent; and potassium, .33 to .49 per cent. If 10 tons of manure are applied to an acre of land once in three years, then 120 pounds of nitrogen, 30 pounds of phosphorus, and 98 pounds of potassium would be added to the soil. A three-year rotation of corn, wheat, and clover, where the crops approximate 100 bushels of grain for the corn, 40 bushels of grain for the wheat, and 3 tons of hay for the clover, removes 266 pounds of nitrogen, 38 pounds of phosphorus, and 120 pounds of potassium. According to this calculation, more plant food will be taken from the field in the grain and hay than is returned in the 10-ton application of average manure. The wheat, straw, and corn stover were not taken into account in this table. These figures serve to show, however, that although manure contains all the fertilizing elements, the quantity returned to the soil under average conditions is not sufficient to equal the amount which has been removed by the crops in question.

Farm manure has given good results when applied to Oklahoma soils, even in cases where continuous cropping is practiced, and we believe that still better returns can be secured in the application of this material to fields which are placed under a systematic course of cropping. In 1893 an acre of virgin soil was laid out for a continuous culture experiment with wheat. This plat was cropped to wheat annually, without the addition of manure or fertilizers of any kind, up to the summer of 1898, at which time the acre was divided into two sections of one-half acre each. One of these received an application of barnyard manure at the rate of 15 tons per acre in the fall of 1898 and another application at the rate of 11 tons per acre in the fall of 1899. This area received no further application of manure until the summer of 1904, at which time the plat was given a dressing of average, well-rotted, farmyard manure at the rate of 18 tons per acre. The manure, which was applied in July, was very moist, and it was therefore necessary to make a heavier application than would have been the case if the manure had been in ordinary condition. The remaining half of the original plat has received no manure or fertilizer whatever, but has been cropped continuously to wheat since the experiment started. Both plats have received the same cultural treatment, as follows: The plowing was invariably done in July, to a depth of 6 to 7 inches, and the soil was kept in a good state of tilth up to seeding time. The yields for an eight-year period are shown in Table IV.

TABLE IV.—*Yields of wheat on manured and unmanured plats in Oklahoma, 1899 to 1905, inclusive.*

Year.	Manured area.		Unmanured area.	
	Grain.	Straw.	Grain.	Straw.
	Bush.	*Tons.*	*Bush.*	*Tons.*
1899	30.60	2.76	12.00	1.31
1900	36.80	2.50	18.10	1.16
1901	37.70	1.43	28.00	....
1902	17.40	1.08	15.30	.74
1903	27.60	2.16	20.30	1.39
1904	15.70	.73	12.60	.57
1905	11.18	1.53	4.75	.55
1906	23.26	2.00	7.10	.72
Average	25.09	1.77	14.76	.99

In this field trial an average increase of 10.33 bushels per acre per annum was obtained by giving the treatment indicated. It is interesting to note that the average yield for the unmanured ground slightly exceeds the average yield for the Territory, according to the reports issued by the National Department of Agriculture.

If we refer again to our calculation on the losses due to cropping, we reach the conclusion that there is a marked deficiency with respect to the element nitrogen, and as no suggestions were made concerning methods of securing this constituent for the crop, your attention is directed to the following paragraph, which appears in Bulletin 74 of the Oklahoma Agricultural Experiment Station:

> The cowpea and soy bean can not only be used to advantage in securing practical results in the management of farm crops, but the plants also serve a useful purpose from a fertility standpoint. These plants, as well as other members of the legume family, are able, through the medium of microscopic organisms which are found in small tubercles or nodules on the root systems, to assimilate free nitrogen from the soil air. This nitrogen is stored up within the plant in an organic form, and if the crop is used as a green manure the nitrogen in turn is rendered available for plant growth. Nitrogen is designated an essential element, and rightly so, because without this substance the plant or crop can not develop. In fields where the supply of nitrogen becomes deficient through the adoption of improper methods of soil management, the crop under average conditions does not make a normal growth; hence, in order to obtain maximum yields on such lands this element is frequently applied in some commercial form. The crop systems which are in vogue in the Southwest favor nitrogen exhaustion; thus, if the present plans are continued it will be but a short time until our lands will cease to return profitable yields. Nitrogen when purchased in commercial form is an expensive element, and if care and judgment are not exercised in the application of the fertilizer serious losses are likely to accrue. On the other hand, the use of legumes—and we speak more particularly of the cowpea and the soy bean—appears to offer a safe and satisfactory solution for the problem of nitrogen restoration. It should be observed that the necessary bacteria must be present in the soil in order to insure the development of tubercles on the roots. In this section the cowpea nodule-producing bacteria are normally present in

the soil, but the soy bean fails to produce tubercles on its root systems. Where the proper bacteria are wanting they can be supplied by obtaining samples of soil from a field where the germs are present and scattering the same on the uninoculated area.

These crops should be given a conspicuous position in our rotation. Inasmuch as the seasons in this section are comparatively long, the cowpeas and soy beans may be used as catch crops to follow wheat and spring grain. Alfalfa should be grown on the best land, and when a first-class set is obtained it will scarcely be profitable to replow the field for at least six or eight years. This plan throws one section of the farm out of the regular order of cropping, but it may be used in the rotation as soon as a second section is seeded to alfalfa.

There is another phase of this subject which should be considered. It has already been remarked that a given crop, Indian corn, makes a much better record in following a crop like potatoes or soy beans than in cases where it follows sorghum or Kafir corn. In the rotation, therefore, some attention should be given to these discriminations. Minnesota Station Bulletin 50 says: "Rotations were begun in 1894, and thus far potatoes followed by mangolds, corn, or field peas, wheat, and flax in the order given best prepared the land for the succeeding crop."

The Rhode Island Station Report for 1897 contains the following statements:

> The average results for two seasons indicate that when potatoes are planted on a clover sod a better yield is obtained than when the crop is planted after corn. The growth of potatoes upon the clover sod plats was very rapid and vigorous, indicating the presence in the soil of considerable available nitrogen. Clover and lupines gave better results when grown after some other leguminous crops than when grown on a soil which had not produced a crop of that class for several years.

There is another item which may have a very important bearing in the arrangement of plans for the southern farmer. It is comprehended in the following statement in Louisiana Agricultural Experiment Station Bulletin 16, 2d series:

> Several years ago the following rotation was decided upon as the best combination attainable in this section. This rotation is corn, oats followed by cowpeas, and cotton. This rotation is faulty in principle but correct in practice and was adopted last season after two years' trial. The corn should precede cotton, but experience has demonstrated that Red Rustproof oats, the only variety successfully grown here, must be planted in October if maximum results are desired. Cotton can not be removed in time for the crop, while corn can.

The rotation may be arranged in courses of any number of successive crops; thus, the farm can be divided into three, four, or five sections, and the form or plan best suited to the particular branch of agriculture in which we are engaged may be adopted.

The following is a good three-year rotation for northeastern Oklahoma: (1) Corn; (2) oats; (3) wheat followed by cowpeas. For the southeastern section of the State the three-year rotation may be as follows: (1) Corn; (2) oats followed by cowpeas; (3) cotton.

These rotations are arranged to meet the requirements of farmers. Farm manure can be applied to the respective fields prior to cropping the area with corn. If a spring variety of oats is used in each case, a catch crop of cowpeas might follow corn, although one could expect a reduction in the yield of corn by following such a method. The cowpea seed can be sown when the corn is "laid by." It will be seen that a winter variety of oats may be used to follow corn; hence, if better results can be secured by using such a variety than in the case of spring varieties, there will be sufficient time to prepare the land and sow the seed after removing the corn. This applies more particularly to southern sections of the State. In the cotton-growing sections a four-course rotation could be arranged by using the three crops included in No. 1. The cotton in this case would follow wheat, and the cowpea crop might be used to advantage for green manure to be turned under after the wheat is harvested.

The following is suggested as a suitable five-year rotation for farmers in central Oklahoma: (1) Corn; (2) kafir; (3) cotton; (4) oats; (5) wheat followed by soy beans. For northwestern Oklahoma the following is suggested: (1) Broom corn; (2) a legume crop; (3) wheat; (4) brome-grass; (5) brome-grass.

It may be stated in connection with the last of these five-year rotations that a legume like cowpeas can hardly precede wheat, provided the seed of the latter crop is sown in the autumn; but, if spring wheat (durum) is grown, such a plan will give satisfactory results. With winter wheat this combination would tend to exhaust the soil moisture and reduce the yield of wheat quite perceptibly. We are not in a position to state definitely whether brome-grass will thrive in the northwestern section, but, as it has given good results in Kansas and Nebraska, we have included the same in the five-year rotation suggested for northwestern counties. In the central and southern parts of the State brome-grass has never given very satisfactory results; consequently, this grass has not been recommended for those sections. Bermuda grass makes an excellent substitute, but it can not be manipulated as well in the rotation on account of its habits of growth. This grass is propagated mainly by scattering the roots in small furrows and covering them with a shallow layer of earth. Such a method requires considerable labor; hence, when a given area has been set to grass it is generally advisable to allow the same to remain down for a period of years. Alfalfa is also allowed to stand for a period of six or eight years. Farm manure can be applied to the land in both of the five-year rotations suggested immediately preceding corn, or it may be incorporated with the soil early in the summer preceding wheat.

The following is suggested as a six-year course: (1) Corn; (2) oats followed by cowpeas; (3) kafir or sorghum; (4) cotton; (5) cowpeas (harvested); (6) wheat followed by soy beans. A five-year course of cropping followed by five years in alfalfa is suggested in the following: (1) Corn; (2) oats followed by cowpeas; (3) kafir or sorghum; (4) cowpeas or soy beans; (5) wheat; (6) alfalfa for five years.

These rotations are somewhat more extensive than the preceding. In both cases legumes are grown on three fields during a given season, and one could plan to use two of these crops for green manure provided the soil is deficient in humus. The stockman-farmer can use such crops to good advantage for feeding purposes, and then return the manure to the land. In the case of the last rotation given, the farm is divided into six fields, and five of these are subjected to an alternation of crops annually. At the end of the fifth year the alfalfa crop is moved to a new section, and the old alfalfa field is used in the yearly series. This plan presupposes that the entire farm is suitable for alfalfa. In planning a rotation the following facts should be taken into account:

(1) The rotation should be arranged to make the very best use of the annual rainfall.

(2) The productive capacity of the soil should be maintained; thus our crop system should be comprehensive enough to include provisions for the realization of this object.

(3) Various crops differ in their moisture capacities; consequently the rotation should be so arranged that one crop will not suffer because the preceding crop consumes an abnormal amount of moisture.

(4) It has also been stated that a given crop may do much better when preceded by a crop of potatoes than in cases where the land was previously devoted to a cereal. The likes and dislikes of the plant should be considered.

DRY-LAND PLANT BREEDING.

By J. H. Shepperd, *Director, North Dakota Agricultural Experiment Station, Fargo, N. Dak.*

The possibilities in dry-land plant breeding are so great that I feel that it will be a mistake not to enlist the side time of each scientific worker who comes in contact with plant life in the region.

Mendel, the Austrian monk, found time from his devotions to breed peas, and incidentally evolved one of the strongest hypotheses that the breeding world has ever received. Hugo De Vries, a Dutch botanist, found time to work upon scientific features of breeding and even to evolve a theory which has set the scientific world agog as to whether he has not more truly solved the question of the origin of species than did Charles Darwin.

The originators of the Concord grape and of the Wealthy apple are alike men who simply caught them up as side issues.

Light horses, poultry, dogs, pet stock, and flowers furnish more evidence of good sensible breeding than do any other classes of living domestic things, and they are simply the result, in a large part, of the side efforts of wealthy people.

You young men represent the only organized body of persons who are interested, in a broad and permanent sense, in the upbuilding of the dry-land region of the West. You are trained scientific men and you are brought in contact with large numbers of plants of the best-adapted sorts which the world can supply, and this enlarges your chance of happening upon the mutant of De Vries, the Concord grape, or the Justin Morgan of the light-horse world.

The climate makes you a strong and unbiased ally in selecting the Darwinian survival of the fittest for the Great Plains region.

Animal breeders hold that the success of Robert Bakewell and the many successful breeders of later generations in old England was due to the fact that live stock was bred so much by geographical districts, more commonly by counties, that the observing breeder by short horseback journeys could see hundreds to thousands of head of the particular breed and class in which he was interested and consequently could select the superior individuals, the result being that the world's breeds of domestic live stock, exclusive of swine, nearly all trace to the "tight little island." Do you not have a similar opportunity, with interested neighbors who are anxious to grow stock of all the new things which you can recommend, who are glad to have you inspect their fields for prime specimens and who will, indeed, aid you in the task?

I am convinced that the Great Plains area has possibilities for producing crops of high quality which the balance of the country can not duplicate. It is a region noted for the clear air and intense sunlight. The fact that it is a dry-land country means more hours of sunshine than other portions of the country have, which, together with dry air, makes almost ideal natural disinfecting conditions. Absence of disease is certainly a great aid to the production of high quality. Dry ripening and curing weather are great aids in the production of high quality of crops, and I shall be surprised if the day does not come when the dry-land region will be looked to as the source of high quality in crop products.

Durum wheat, nonsaccharine sorghum, and several of the horticultural plants are sufficient indication that there are special types of plants particularly adapted to the dry-land region. The successful culture of slender wheat-grass (*Agropyrum tenerum*), Burbank's spineless cactus, and Hansen's native fruits indicates that foundation and acclimated stocks may be at your very doors if you will but guide nature's acclimated products into cultivated-plant channels. You are really engaged in a battle of conquest. You are at work upon a plan calculated to add territory to the profitable farming country. You are doing much by methods of moisture conservation and have much in prospect from that line and from the study of a sensible method of cropping, and it seems to me that it will be a fatal mistake not to take in this third ally—plant breeding—if not on an extended scale, certainly as a side line.

To those who go into plant breeding I would suggest two things: First, do not undertake too extensive a line of work; second, make sure to keep a plain, easily traceable record.

Interest in too many lines of breeding work will scatter your energies too much and force neglect. It is hard to throw away breeding stock, and especially when you have not worked it over thoroughly, as there is always the fear that you are throwing away the one which should be kept.

Keeping a record of plant-breeding stocks soon becomes a serious matter, as they rapidly run into large numbers and many generations. A plan of record keeping which would answer the needs, at least of those who practice plant breeding as a side line, is to indicate series by the letters of the alphabet and generations by figures.

One of the great needs of the dry-land region is the breeding of legumes, particularly clover and alfalfa; also the development of suitable grasses. In that work special provision will need to be made to prevent your climate ally in selection from destroying your entire stock. Nature's selection is spasmodic, and during some seasons it is so severe as to eliminate good and bad alike. It is always wise to make provision for the future by saving a portion of your seed supply for a start during a second season. With the legumes and grasses at least two seasons' failure should be guarded against, for in addition to winterkilling there is the chance of a failure to secure a "catch" of plants which will be able to live through the trying times of the growing season.

I am convinced that there is great opportunity for improvement in the forage crops for the dry-land district, and particularly among the nonsaccharine sorghums, which can be selected and handled in much the same manner as corn breeding is done. Since they are annuals the chance of losing your entire improved stock of seed is much less than it would be with a biennial or perennial plant. They have individuality like corn, and hence are more easily handled in the nursery and in the pedigree record.

In closing let me urge that those employed at stations where the breeding work is not undertaken by a special man be upon the alert for the strong-constitutioned, vigorous, heavy-yielding, thrifty plant whose descendants are liable to be especially valuable. Those who come in contact with plants in large numbers have the chance to discover the Shakespeare of the species, and if De Vries's mutation theory is right it may be that a ready-made constant producer of a similar sort will be sighted. In any event it will prove an interesting line of study for the young man who gives it attention.

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